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Cold Fusion and New Energy Technology
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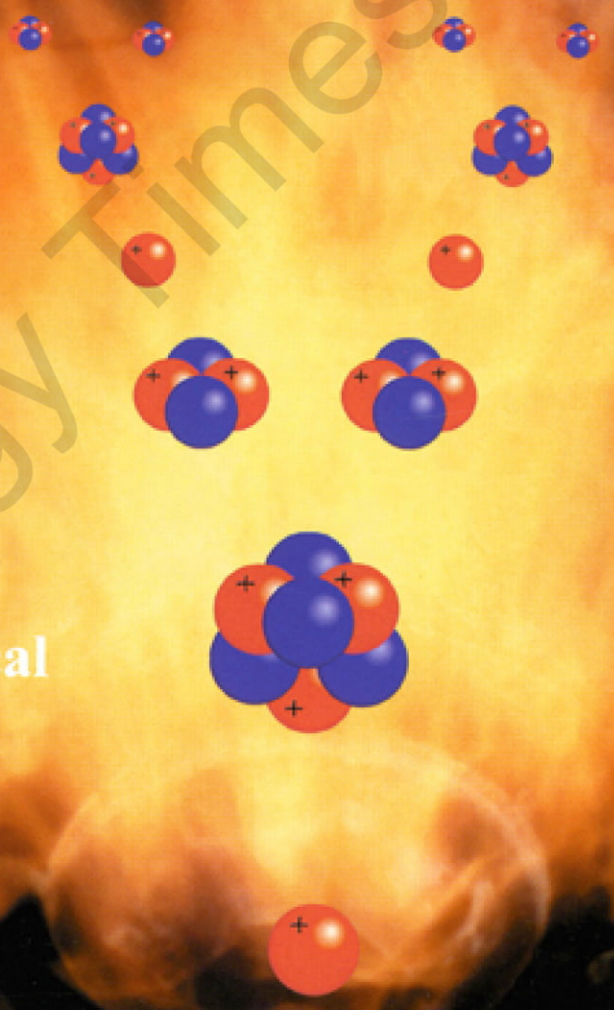
Nuclear Augmented Combustion Emerges



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(SEE **IE** ISSUE #17 FOR JED ROTHWELL'S REVIEW OF THE JAPANESE EDITION)

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Cold Fusion and New Energy Technology

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About the cover:
Our cover story concerns a new and very unusual phenomenon, for now designated "Nuclear Augmented Combustion." The cover image illustrates one possible explanation for this phenomenon based on a chaining reaction involving Lithium-7, hydrogen, and alpha particles. The flame image is adapted from an actual photo of an augmented combustion experiment, and was generously provided by Crystal Energy, Inc. *Artwork and cover design by Jeremy T. Slayton.*

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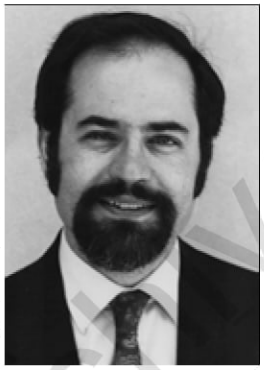
By Eugene F. Mallove, Sc.D.

WELCOME ICCF-7!

— Seeing the "Big Picture"



For those fortunate enough to be attending the Seventh International Conference on Cold Fusion(ICCF-7) - a very big ***Welcome*** from the staff of *Infinite Energy* Magazine!

If you are at ICCF-7 in beautiful Vancouver, Canada, you have before you a complimentary copy of a magazine with global reach—it has subscribers now in 37 countries. Attendees at ICCF-5 in Monte Carlo (1995) and ICCF-6 in Hokkaido, Japan (1996) received earlier issues. For those few who haven't done so already, isn't it about time to subscribe and get "The Big Picture" on Cold Fusion and New Energy six times a year? Join those few thousand lucky people who don't have to wait 15 months between international conferences to receive the next issue of *IE!*

We in the cold fusion and new energy community are scientists, engineers, technicians, inventors, investors, environmentalists, perceptive journalists, and concerned citizens. We know that the pathway before us leads ultimately to the end of the Fossil Fuel Age and the end of "business as usual" by the Scientific Establishment—ignoring and disparaging data that does not fit preconceived "theories of everything" in physics. Please see our new "Words to Eat" feature (first in a series!) that recalls the silly and hurtful insults against us by academics who don't much care to "look through the telescope" at revolutionary vistas.

Those of you who did *not* make it to Vancouver will be getting a full report from *Infinite Energy* in Issue #19 (to be published by late May 1998) as we enter our fourth year of service to the cold fusion and new energy community. ICCF-7 will no doubt have new reports of nuclear-scale excess energy in both heavy and light water systems. There will also be reports of helium production associated with excess heat, which was one of the first nuclear pathways proposed for cold fusion reactions. In this issue, engineer Mike Carrell provides an excellent and thorough overview of the excess heat and helium work of Drs. Arata and Zhang, which is sure to be examined anew at ICCF-7.

Two feature stories in this issue give remarkable testimony to the need to keep in mind "The Big Picture." The provocative "Nuclear Augmented Combustion" tells of an excess energy phenomenon in fossil fuel combustion that has solid data supporting its general features. A very small addition of lithium compound to fossil fuel prompts dramatic changes in combustion energy—and there are good measurements of alpha particles from the flame as well! They need to be confirmed, of course. But there is *overwhelming* evidence supporting an excess energy beyond the pre-measured chemical energy for the power boiler systems tested. The measurements are absolutely conventional — standard stuff that cannot be pierced. The energy augmentation per atom of lithium potentially reacted is in the million-electron volt (MeV) range. Hmmmm...? Smells nuclear.

Then "Enter Miracle #2"— the startling effect of "Electrochemical Activation" that is the *immediate* answer to the quest for dramatic reduction in the energy cost of producing clean water. (See how quickly Dr. Cravens' plea in Issue #17 was answered!) But that's not all. The confirmed and technologically implemented phenomenon implies physical mechanisms within water that for now appear impossible to fit into conventional physics. Lovely. Cold fusioneers: learn from this and expand your vision.

As reported in many previous issues of *Infinite Energy*, the observation of heavy element transmutation in cold fusion cell materials—what I have termed "electroalchemy" (see Double Issue #15/16)—is becoming an increasingly prominent feature of this science. Certainly the generation in cold fusion experiments of tritium, helium, very low-level neutrons, and other nuclear signatures were initially a shock to those who now find themselves convinced by the evidence. Yet it has been harder for these same people to accept that heavy elements can be cold fusion-fissioning in similar systems. This is a major expansion of the Big Picture.

There are now at least two companies (CETI and the Cincinnati Group) that have technologies for changing radioactive elements, such as uranium and thorium, to lower atomic weight non-radioactive species. These claims have been significantly validated by independent laboratories; there *may* even be a few reports of these validations presented at ICCF7. Moreover, work by scientists associated with the U.S. Dept. of Energy nuclear waste remediation effort is inexorably leading to acceptance of this technology within that community. This is the "back door" of cold fusion that will inevitably *force* the Department of Energy to re-examine its negative rush-to-judgement report of 1989.

What is the lesson in this brief history? Simply to keep one's mind fully open for surprises connected with excess energy and nuclear changes at low energy. In other words, it is not scientifically helpful —frankly it is downright *unseemly*—for "mainstream" cold fusion people to ignore the full body of evidence that is emerging. You certainly don't have to accept it all before doing your own due-diligence, but how can science in this field proceed effectively when some cold fusion scientists consciously ignore or avoid data that may be a bit unsettling to *their* preconceived theories or experiments? As an example, there was a bit of that at ICCF-6, when one senior and respected scientist in his summary of ICCF-6 failed to mention the transmutation work that had been reported there. We trust that will not happen at ICCF-7.

There are many other parts of this Big Picture besides heavy-element transmutation, though that is one of the most important additions. Cavitation-produced excess heat and associated nuclear changes is one new direction to which you should be very open. There have been many failures and successes in this area, but we have always had faith that the evidence is basically correct.

We had intended to run a cover story on a newly-emerged water-based cavitation reactor, which appears from data reported to us to be massively over-unity at the multi-kilowatt level. We hope to have this device profiled in Issue #19, once we have either verified or rejected,

Editorial continued on page 5

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Editorial continued from page 3

with our own measurements, the alleged extremely promising and fully repeatable performance. Bear with us and stay tuned.

In this Big Picture are also underwater "arcs and sparks"— a primary example being the apparently over-unity energy generation in water-carbon arc systems (AquaFuel or CarboHydrogen™ gas—see *IE* issues #9 and #10). Any system that involves electric excitation with hydrogen has to be examined very closely for possible anomalies. These systems include not only water-based devices, but the gas-phase regime explored by Dr. Jacques DuFour.

There is another important message from The Big Picture that we have distilled from nine long years of the "Cold Fusion War." It has been a very hard lesson to learn, but we have no doubt that it is true: Sad to say, no matter the quality of a published scientific paper in excess energy or low-energy nuclear transmutation, whether it is peer-reviewed or not, it will NOT convince most members of the Scientific Establishment that this field has any merit.

And just what is this powerful "Scientific Establishment"? Start with *Science* and *Nature* magazines, which are the key barometers of the world of science. Do you seriously think that either of those centrally influential magazines has any intention of *ever* publishing anything like the many quality peer-reviewed papers in this field that have been published elsewhere? If you think so, think again, because you are seriously wrong. The appearance of even *one* such paper in either of those journals would be the death-knell for the despicable farce that those journals have perpetrated against cold fusion. Know well that virtually no scientist in this field is any longer hopeful enough to waste his or her time submitting cold fusion papers to these journals.

What does this mean? It means that all but a small handful of the several thousand science journalists in the world are going to ignore you and your work or will write in disparaging or tongue-in-cheek terms about cold fusion. The prototypical format has become familiar: "Ha, ha, hee, hee! Cold fusion scientist-X says that he can produce nuclear-scale excess heat and perform low-energy transmutation of elements! We all know that's impossible. There is no theory that would support this claim, thus it is rubbish. Aren't those pathological cold fusion people ever going to learn?"

A recent real example: science reporter William Broad of the *New York Times* was shown the excellent published work by Drs. Arata and Zhang in the *High Temperature Society of Japan* journal (January 1997). He said he would not write anything about it unless it was first reproduced by someone else—perhaps someone in the U.S. Hah! If that standard were applied to reports of *hot* fusion experiments or high-energy physics, there would be precious little about those topics written in newspapers and popular magazines. Broad is not inherently a bad man. He is a good writer, and what he covers, he generally covers well. It's just that he knows what will happen to him if he wrote about cold fusion in other than mocking terms. So, he thinks, "Best to ignore it."

The physicists would cut him off from access to them as sources and would attack him for writing about cold fusion. He would lose respect. He saw how they trashed Jerry Bishop of the *Wall Street*

Editorial continued on page 24

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LETTERS TO THE EDITOR

Thank you for including my article and speeches in your latest issue. In spite of my contributions, every issue of *IE* is more interesting than the previous issue. How long can you keep this up?

Art Rosenblum's interview of Randell Mills interested me greatly and led me to write the following:

Volume 3., No. 17 of *IE* included extremely interesting conversations between Art Rosenblum and Randell Mills (pages 21 through 35). Mills gave strong evidence that lower energy states of hydrogen exist and that large quantities of energy are evolved when hydrogen is converted to a lower energy state. The same issue of *IE* included articles by me (pages 79 through 85) which attempted to demonstrate that hydrogen gas has been produced in and from vacuum under surprisingly mild conditions. My articles suggest that vacuum is not a void but, rather a matrix of protons and electrons, which under the proper conditions can be converted into hydrogen. I claimed that such conversion requires considerable energy and suggested that converting hydrogen into vacuum should produce considerable energy.

Could my matrix of protons and electrons be Mills' lowest energy state of hydrogen? If so, Mills' energy producing process simply adds to the matrix of protons and electrons (vacuum) which I propose fills the knowable universe. There should be no worse environmental effects than there are from producing water in the ocean.

As I understand Mills' process, it involves conversion of hydrogen atoms into a lower energy form of hydrogen at high temperature using vaporized potassium as a catalyst. The following suggests that the same effect might be achieved under milder conditions:

In a 1905 article (*Phys. Rev.*, Vol. 21), Clarence Skinner of the University of Nebraska described the evolution of hydrogen at the cathode during low pressure discharge in purified, low pressure helium. The following quote is from pages 4 and 5 of his paper:

"Sixteen different kinds of metals have been tested as cathodes and all except two found to give off hydrogen at a measurable rate. The exceptions were the Na,K alloy, which as cathode absorbs hydrogen, and mercury which was distilled in vacuo, then tested without having been in the meantime exposed to the atmosphere."

The conventional explanation for such hydrogen removal is the formation of hydrides at the alloy surface. However, the similarity to Mills' observations at higher temperatures may indicate that an alternate possibility is worth considering. Sodium, potassium alloy (Na,K) melts at a much lower temperature than either sodium or potassium. Skinner's equipment produced up to 2000 volts DC. Likely, the heat produced by his discharge melted the alloy. Could the negatively charged, molten alloy have catalyzed the conversion of hydrogen into a lower energy form at much lower temperature than required by Mills?

A 1914 article by Collie (a Fellow of the Royal Society), Patterson and Masson (*Proc. Roy. Soc.*(A) 91) may also be pertinent. They performed electrical discharge experiments in many different tubes and under various conditions. The following quote (pages 32 and 33) concerns discharge in hydrogen using aluminum electrodes in a glass tube surrounded by vacuum:

"But the remarkable fact was noticed that the hydrogen (4.6 cc) admitted to the inner tube and sparked at the end of the experiment had diminished to about 0.4 cc. Moreover, after breaking up the tube and melting the electrodes and the powdered ends of the inner tube in a hard glass tube, only 0.6 cc of hydrogen was obtained. This apparent disappearance of hydrogen is always a noticeable fact during the discharge, and up to the present has not been entirely explained."

Pages 36 and 37 of the same paper discusses arc discharge in an inverted U-tube with a capillary tube incorporated at the top. Each arm contained mercury which made up the electrodes. The whole arrangement was under water.

"An experiment was made in which hydrogen was admitted without affecting this result; it was noticed, however, that after about 10 minutes of passing the arc discharge the whole of the hydrogen (about 1 cc) had completely vanished, and the mercury could be driven to the top of the capillary."

If the hydrogen which "disappeared" had been converted into a lower energy form of hydrogen with the evolution of heat, excess energy was produced under quite mild conditions in simple equipment.

Keep up the great work;

Paul E. Rowe
Mashpee, Massachusetts

As always, your contributions that speak of astonishing "loose ends" in experiments this century are fascinating. Maybe they do *have something to do with Mills' work. We will "keep this up" for a long, long time!—EFM*

•—•—•

Thanks for printing my shot at "Demystifying the Marinov Motor,"[1] as well as Jeff Kooistra's most kind review[2] of my *Heretical Verities* book. Physics research, at least on the experimental side, is a continual wrestle between human demystifications and nature's remystifications. At the moment I am not sure who is winning, but must report some new licks that nature has got in since Jeff[3] and I wrote our accounts of the Marinov motor for your last issue. First, there is a matter of algebraic signs. Some sage has said that signs are the hardest part of physics. I have to agree. Also the most important, as can readily be seen by changing the sign on Lenz's law. Let me confess, then, that I made a sign mistake in what I wrote. I have carefully checked and now agree with the Wesley analysis[4], cited in my paper. The theory is thus clear and agreed upon: Where I described the predicted sense of turning of the Marinov motor rotor, CW and CCW should have been interchanged. (Any very attentive reader must have been puzzled by the discrep-

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ancy between what I said and the Wesley figure that Tom Ligon redrew as the first figure in Kooistra's paper.[3] The figure concurs with Wesley's theory.)

So, all is well, theorists agree, and the music of the spheres resolves itself into Keplerian harmonies? Not quite so fast. Nature has not been heard from. It turns out there are different ways of putting together magnetic toroids — you can have vertical permanent magnets and soft iron keepers top and bottom, you can have vertical soft iron straps and strong magnets top and bottom, you can have permanent magnets all around, you can even have solenoids. And, sad to say, although all such toroids may be arranged with similar internal flux circulating in the same sense, not all (when so arranged) produce the same observed sense of rotation of the Marinov motor (!). This is an evolving research topic, so I shall not try to give a coherent account of it in this letter. In the mystification wrestling match I mentioned, at the moment nature is well ahead on points. As you see, cold fusion researchers are not the only victims of nature's whims.

The truth is, anybody who actually goes into the lab and does experiments soon discovers where the medieval conception of the devil originated. For a hundred years physicists have lost sight of this elemental truth, for the supremely simple reason that once out of undergraduate courses almost all of them have systematically shunned the laboratory. They have done this not through perversity but because tenure and promotion have depended on their doing just that. It was not only publish or perish, it was stay clear of the lab or accept second-class citizenship. The social dynamic responsible for this state of affairs would make an interesting book, perhaps supplementary to *Decline of the West*. Spengler, who originated that title, viewed the human intellect as overstrained and simply ready to go to sleep. On the contrary (or compensatorily), within the academic scientific stratum during this century intellect has arrived at a new plateau of self-sufficiency (once Einstein showed the way) and now feels itself disgraced if caught sneaking a peek at nature. Hence the shunning of the laboratory by the average theorist, who would lose face among his colleagues if he acknowledged any inadequacy of his intellect to function without facts. I am, to be sure, overlooking certain high-energy and hot fusion subcultures of physics . . . but that was in a different country and besides the funding is dead.

Finally let me mention a technical point relating to my discussion of gauge invariance. The retentive reader may recall that Dirac "streamlined" the EM force law in effect by adding to the Lorentz force law an extra term $-q\nabla(\mathbf{v}\cdot\mathbf{A})$. I asked why this added term was not easily observable (as must be true, else the repercussions would have reached even the most self-sufficient intellects among our theorists). In a first draft I suggested that the term was not observable *because the gradient integrates to zero around closed loops, and practically all electrical circuits are closed.* For some reason I lost the courage of my convictions on this point and decided to omit it. However, in the interim, I found that some Venezuelan physicists (there's still physics going on in the third world) have recently made exactly this points.[5] So, now I have recovered my Dutch courage and think the point worth emphasizing. What I had to say about gauge transformations in this connection merely obscured the matter.

To recapitulate, the full electromagnetic force law can be written in the form

$$\mathbf{F} = q\left[-\nabla\phi - \frac{\partial \mathbf{A}}{\partial t} + \mathbf{v}\times\mathbf{B} - \nabla(\mathbf{v}\cdot\mathbf{A})\right],$$

where the last term is needed to account for the running of the Marinov motor. This extra term vanishes (1) if we integrate current q**v** around a closed circuit, or (2) if the vectors **v** and **A** are mutually perpendicular. Now, to end on a political note, let us notice that in a hot-fusion plasma neither of these conditions is satisfied. Charge interactions do not depend on closed-path motions, and perpendicularity is generally invalid. Because of chaotic averaging in plasmas, **v•A** or its gradient can produce no unidirectional translatory displacement of plasma. So nothing obvious, nothing grossly at variance with expectations conditioned by the Lorentz force law **v**x**B**, will be observed. But how about subtler influences? For example, may there not be an effect of the extra force term on *diffusion rate* — the rate at which a plasma "comes apart"? You can see why I should be profoundly startled if the Marinov motor were well received at Princeton. Indeed, that would be fatal to all my Harvardian presuppositions.

With highest regards,
Thomas E. Phipps, Jr.
Urbana, Illinois

(1). T. E. Phipps, *Infinite Energy* 3, #17, 43 (1998).
(2). J. D. Kooistra, *Infinite Energy* 3, #17, 49 (1998).
(3). J. D. Kooistra, *Infinite Energy* 3, #17, 40 (1998).
(4). J. P. Wesley, "The Marinov Motor, Motional Induction without a Magnetic B Field,' *Apeiron* (to appear).
(5). R. Angulo, O. Rodriguez, and G. Spavieri, "Does the Expression for the Lorentz Force Need to be Modified?", *Hadronic Journal* 20, 621 (1997).

We are so grateful for your continued eloquent illumination of the basic physics of this remarkable Marinov motor. In Issue #19 we will publish your engineering *assessment of its potential: "Motor-in-a-Wheel: An Application of the Marinov Motor"—EFM*

•—•—•

Re: The Interview with Dr. Randell L. Mills in *Infinite Energy* ,Vol.3, No. 17.

In his model of the hydrogen atom, Bohr made the assumption that the only allowable orbits are those in which the electron's angular momentum is equal to integral multiples of $h/2\pi$. Had he instead assumed that the orbits were confined to harmonic multiples of the de Broglie wavelength, he would have arrived at the same value of the Rydberg constant without going beyond classical physics.

What prevents the electron's decent into sub-harmonic de Broglie orbits on its own, even though the resulting hydrinos are stable? My hunch is that the interference pattern created by the de Broglie wave cannot sense the sub-harmonic orbits, i.e. the electron cannot see beyond a single orbit, so consequently cannot be aware of the existence of lower-energy stable orbits.

One further observation that must have crossed the mind of many readers. If hydrinos are produced in the various electrical discharge experiments but escape undetected through the container walls, then the quantity of hydrogen produced must have been under-estimated. Surely some experimental method could investigate this matter.

It is time for the experimentalists to reclaim physics from the theoreticians.

Charles Stuart
Titusville, Florida

Excellent point to bring up about that escaped hydrogen. How about it Dr. Mills, or Professor Farrell? What say you?—EFM

•—•—•

The argument over the legitimacy of Pons and Fleischmann's boil-off experiment has a hidden error in the analysis of the results. "Official Japanese New Hydrogen Energy (Cold Fusion) Program to End - Missed Opportunities and Botched Management," by Jed Rothwell and Eugene Mallove in *IE* #15/16 speaks of lithium electrolyte present in the condensate that is assumed to come from droplets carried over in the vapor in the distillation occurring during boil-off and therefore the excess heat calculated is not as great as claimed. As a chemist, I have first-hand experience with condensate contamination from laboratory distillation procedures that can shed some light on the truth of this debate.

Droplets may not be the only way to carry electrolyte to the condenser. The electrolyte contamination can come from a continuous film of water on the walls of the vessel all the way from the boiling reactor to the condensate collector that wicks the electrolyte in liquid form by osmotic pressure, capillary action, surface tension reduction, or whatever you

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want to call it. It is not a foregone conclusion that droplets carried the electrolyte into the condensate. Whether droplets or a steady stream in the form of a film carry the electrolyte, either mechanism can ruin the results. The way to eliminate the wicking water film is to heat the connecting passage a degree or two higher than the boiling liquid so that the passage is dry. A demisting chamber is necessary prior to this dry connecting passage to avoid boiling the spray and splashes by the outside heat source, a plug of fiberglass wool will do. If demisted, the slight added heat will not contribute to increased evaporation and will not add error to the true excess heat transferred by heat of vaporization, but it will eliminate a source of error from liquid migration by capillary action.

By eliminating the liquid phase from being transferred, authentic numbers can be calculated by condensate collected times heat of vaporization at the pressure of the test vessel.

Kenneth M. Rauen
Gregory, Michigan

A very novel observation about the P&F boil-off experiment, which again shows the intellectual vigor of the IE Readership.—EFM

•—•—•

I just recently subscribed to *Infinite Energy* magazine and I am amazed at the wealth of information your publication provides. However, being a non-scientist it would be helpful to have a few articles on a beginner or tutor level to help bring me up to speed. I have a broad background in Engineering, but particle physics and quantum mechanics are far from my field of expertise. The recent article on "Neutrino Power" by Graham Toquer in *IE* vol. 3, No. 13/14 was a great example of how difficult concepts can be expressed without a lot of techno-jargon.

Also, when I subscribed to *IE* I ordered a copy of your "Starflight Handbook." I have an intense interest in advanced space propulsion theories. The book was fantastic! An article in a future volume of *IE* on this topic would be great to see!!

J. M. Allen
Ft. Leavenworth, Kansas

Thank you. We'll try to oblige with a review of advanced space flight applications of cold fusion and new energy in a future issue.—EFM

•—•—•

We are very pleased to learn of your recent gift, which you designated for use by the Department of Electrical Engineering and Computer Science. Thank you very much. We will make use of these funds to support the education and research activities of the Department.

Your gift will be used to support a wide variety of educational and research needs of the Department. The flexibility you have provided us enables us to apply your gift where it is most needed.

The Department depends quite heavily on gifts such as yours. Your generosity is very much appreciated.

We in the department are always striving to merit your continued support. Please let me know how we can do better.

Again, on behalf of the entire Department, let me thank you for your donation.

Sincerely yours,
Paul Penfield, Jr.
Department of Electrical Engineering and Computer Science
Massachusetts Institute of Technology
Cambridge, MA

My small personal contribution was for the cold fusion work of Prof. Peter Hagelstein. This MIT alumnus (Mallove) no longer donates to the general MIT alumni fund. I am waiting for the administration of MIT to apologize for and correct the outrageous behavior of certain administrators and staff against cold fusion. (See "Words to Eat," this issue, p.44)—EFM

•—•—•

I'll sign up for just one more year. We still haven't seen a real CF product on the market yet, will we ever? Tried a CF experiment myself — copper coated BB gun beads with 650 Å electroless nickel coating — car battery charger at 6V — in stainless steel cup/stainless steel knife blade for anode —KOH electrolyte =black yuk/flakes was the result (with minor heating). It is easy to see why so many have given up on CF.

Wayne Powell
Kalispell, Montana

Wayne, we appreciate your frustration (and your support), but know well that real CF scaled-up devices ARE now in commercial prototype form at several companies. Larger industries are making concrete plans to license this technology for rapid introduction. I trust that you will not use your single home-brewed experiment as an indicator of the reality of this field!—EFM

•—•—•

I would like to thank you for the time you spent me during our recent telephone conversation and for the copy of "Infinite Energy" you sent me. It will take me some time to understand what has been written there, since I am not well versed in the physics aspect of cold fusion.

It appears to me that the following holds true:

(1) The cold fusion effect is a bulk effect, not a surface effect, else a 1 cm cube of palladium would not have melted down, as was indicated in one section.

Since hydrogen and its various isotopes are easily filtered through palladium, the atoms of deuterium are very loosely bound to sites in the crystal lattice, assuming that the deuterium indeed passes through the crystal lattice and does not flow along the discontinuities introduced at crystal boundaries. Since there is some question in my mind about that, I would appreciate it if you could tell me whether cold fusion has ever been attained in monocrystalline palladium.

(3) I have read that microcracks were observed in the palladium, either before or after having been exposed to deuterium. The question that arises now is did cold fusion cause the microcracks or did cold fusion take place in the microcracks?

(4) In the original experiments, the palladium was supplied by Olin Matthiesen and was returned to them. Nothing was revealed regarding the crystalline structure of the material either before or after the experiments. I personally believe that the crystalline structure has a great deal to do with the suitability of the palladium for use as an electrode.

(5) In at least one of the results published, it was noted that considerable pitting had taken place at the palladium electrode. I speculate that this was caused by a multiplicity of nuclear events taking place at crystal boundaries. I have no way of confirming this, but would welcome your comments on this possibility.

Speaking as an engineer, it is at this time only a scientific curiosity to have cold fusion taking place in an electrolyte. The generation of heat a this low intensity makes the process suitable for heating water but not for the generation of electric power or high pressure steam. I have not yet heard of any tests conducted under high pressures, so as to generate heat at higher temperatures.

I was very interested in the results obtained at CETI but have been informed that the microspheres that they use become contaminated by the transmutation of the original materials, hence will have a limited life. It is my opinion at this time that transmutation can only take place by the existence of free neutrons, this tends to confirm the fact that nuclear events are taking place. In addition to that, the demonstration of the nullification of radioactivity in a considerable fraction of the radioactive material present surely reinforces the conclusion that free neutrons are present.

In looking over that various technologies that I am aware of, it appears to me that the work done at CERN by Dr. Carl Rubbia, combined with the work done by Shoulders, Fox, Jin & Bass to gather with several others, will result in technology most likely to succeed in terms of economical power generation for both small scale and large scale plants. The small

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scale plants should be realizable in a size and power capability for both home use and for driving automobiles. In addition, of course, there is the valuable property of reducing, in specially built equipment, the radioactivity produced by fission plants, as well as larger equipment for industry.

During our conversation I mentioned that a mass spectrometer should be used to separate out electron clusters during initial experimentation. On further consideration, I believe that the range of atomic masses will be so low that the job can be done with a permanent magnet and a moveable target or mask at the target.

The advantage of doing things this way is, of course, that the target material is deliberately used up as the fuel and is easily and conveniently replaceable. The problem of removing the desired heat from the target is also much reduced since the target can be made essentially two dimensional and can be constructed in a manner similar to that of rotating anode X-Ray tubes, with a centrifugal pump built right into the target head.

The engineering problems involved in the generation of charge clusters can be solved by technology now in existence, beam bending in the final design should not be necessary and the cost of energy generation should be within a reasonable range.

The above communication represent only my thoughts on the problem of energy sources for the next century and are not in the form of a paper which can be published. I have not done any experimental work, nor do I propose to since I am an electronics engineer and not a physicist and lack a considerable amount of physics education and experience.

Please feel free to use any or all of the above material in any form you may wish to. I would like to thank you in advance for any comments you may want to express.

Hans Weigert.
Pittsford, New York

I must add a correction to your many very astute observations—articles by Dr. Storms answer most of them. Contrary to your understanding, it is now true that CF reactions have been observed at BOTH high temperature (2000 C) and high pressure -- several atmospheres. The way is now open to electric power generation, even though water heating will be the first commercial application. — EFM

•—•—•

I have read with a very great interest the article of Dr. Puthoff entitled "Can the Vacuum be Engineered for Space Flight Application? Overview of Theories and Experiments" which has been published in *Infinite Energy*, No 15/16, pp.72-75. With a very large argumentation, Dr. Puthoff shows that the vacuum can be an energy source. The zero point energy (ZPE) may be a key, which will give the solution either in theoretical or in practical problems. On the basis of laboratory demonstrations and taking into account various phenomena, as the Casimir effect, he shows the importance of ZPE. It is important to mention the phrase "...energy is provided...and the ultimate source of this energy appears to be the zero point radiation of the vacuum continuum."

With a very large argumentation, he shows that the vacuum can be a source of gravity and inertia. It is important to mention the following paragraph:

"...Many researchers see the vacuum as a central ingredient of 21st-Century physics. Some even believe the vacuum may be harnessed to provide a limitless supply of energy. This report summarizes an attempt to find an experiment that would test the Haisch, Rueda and Puthoff (HRP) conjecture that the mass and inertia of a body are induced effects brought about by changes in the quantum-fluctuation energy of the vacuum...It was possible to find an experiment that might be able to prove or disprove that the inertial mass of a body can be altered by making changes in the vacuum surrounding the body."

It is also important to refer to "Engineering the Vacuum for Warp-Drive." M. Alcubierre proposed a method of hyperfast propulsion by spacetime contraction in front of the vehicle and expansion behind. Although he did not show the quantitative correlation between the spacetime distortion and the force experienced from it, he showed the possibility to apply the GRT [General Relativity Theory] in the creation of a new kind of force. (This information I have also from the article of E. J. Jeong, entitled "Rotating Hemisphere: Center of Mass Shift." presented in St. Petersburg, 1996).

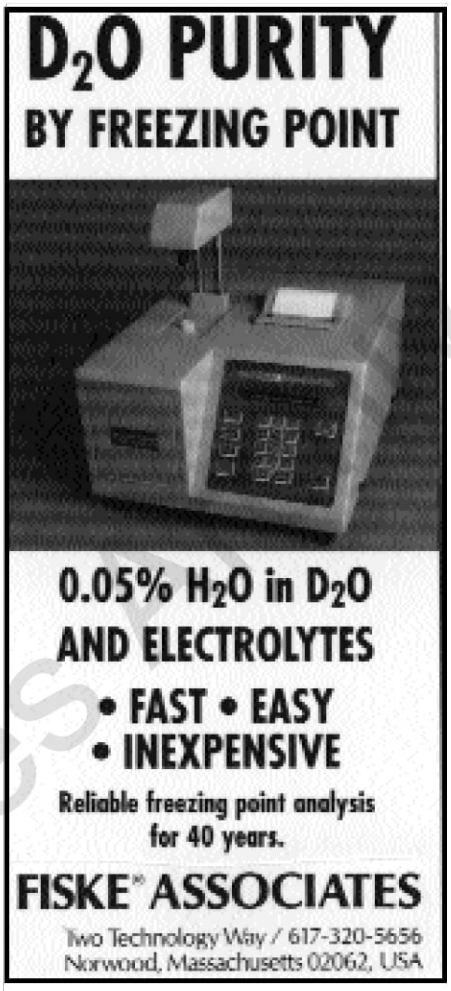
According to Dr. Puthoff's overview, spacetime is a different notion from matter.

An alternative proposal for the above mentioned problems is that quantum spacetime itself is matter. This point of view is expounded in my article in "*Infinite Energy*" No. 13/14, pp. 120-124, entitled "The Hypothesis and the Equations of the Unified Matter Field." According to this hypothesis, the product of an energy eigenvalue of a particle field times the mean volume, which contains this energy, equals hc. Thus, when volume expands, energy decreases and radiation is emitted in order that the energy balance is kept. These are expressed in eqn. D in the introduction of the article.

Eqn. C of the same article shows the formula of gravity acceleration in any matter system. Taking into account this formula, we conclude that the attraction on an object is attributed to the fact that the space under the object attracts the object more than the upper one. If we succeed to lower the relative time beneath the body, then we would have an ascending movement of the body (Figure 1 a,b, p.124). The lowering of time, according to this hypothesis, is equivalent to the lowering of the local energy since there is an equivalence between energy and internal time in any infinitesimal spacetime, see p.121, lines 1-19, lst column. The lowering of time might be done through an electrogravitational process, see Discussion par. 2.

In order for a reader to have a better access to this article and specifically to "introduction", to "Verification" and to "Discussion," I would like to stress some of its main points:

1. "Any infinitesimal spacetime can be regarded as a particle wave."
2. "The energy of any oscillating infinitesimal spacetime is equivalent to its internal time," where as internal time is defined a time τ of a phenomenon of comparison."
3. "Any physical magnitude can be expressed equivalently in a co-ordinate system of a Euclidean space-time of reference, both as a spacetime magnitude."
4. Any matter system locally is equivalent to a particle field.
5. A particle field, which describes the space as a whole, consists of one gravitational field and one imaginary gravitational field, which can be regarded as electromagnetic space.



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6. Each gravitational field is distinguished in matter and antimatter through the formula of probability density of Schrodinger's relativistic equation. This formula P(r,t) is positive for matter and negative for antimatter. On the basis of this hypothesis, the following phenomena can be explained: a) The black hole's radiation as a result of Universe's expansion, see reference 7; b) The second thermodynamic law can be explained as a result of Universe's expansion. A first approximation is given in the discussion of the mentioned paper, par.2; c) The property of self-similarity in spacetime matter systems. It is noted that this property can be compared to self-similarity, which derives from fractal geometry; the latter has been widely applied; d) The reason why ions attract or repel can be shown; e) On the basis of Gödel's work (not theorems) we can reach the conclusion that spacetime is a stochastic phenomenon, *ie.* it may be matter. (See "Introduction.")

More details on the points 1 to 6 and on what is mentioned in a,b,c,d,e exist in my article: "The Hypothesis of the Quantum Space-Time, proceedings of IV int. Conference, Russian Academy of Science, St. Petersburg, 1996. A modified and more consistent, in my opinion, version of this paper can be at your disposal.

Taking into account the above, I think that it is important to discuss the following question: **Is matter something different from spacetime or quantum spacetime itself is matter ?**

The answer to this question has a philosophical and a pure scientific dimension and it might lead to a better understanding of nature, a fact that beyond its own significance, could also have practical consequences.

Yours Sincerely, Prof. Dr. A. A. Nassikas
Larissa Ed. Inst. of Technology, Larissa, Greece

Errata:

IE Issue #17, pg. 41., 3rd column, 1st paragraph:

"and there will be *nothing* ambiguous about it--it's quite brisk even when *using a 12 volt* lantern battery as a power supply. After *it's rotated about 90* degrees, it hits an area of the ring where the *polarities are* reversed and its tendency will be to rotate *in the other* direction.

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INVITATION TO ATTEND SPECIAL SESSIONS AND WORKSHOP ON LOW ENERGY NUCLEAR REACTION AT THE ANS SUMMER MEETING IN NASHVILLE June 7 - 11th, 1998

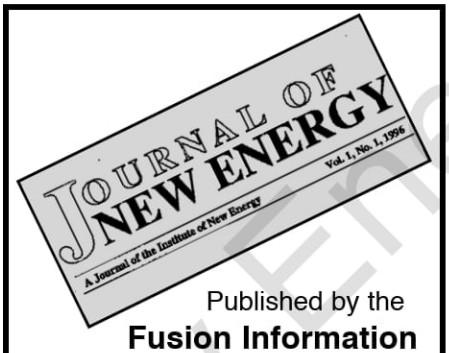
Transmutation and Isotope Production by Low-Energy Nuclear Reactions in Solids represent a new area of nuclear technology that has grown out of, but is distinctly different from "cold fusion". There is strong evidence that transmutation products ranging from tritium to a spectrum of product isotopes can be created in select solids like nickel and palladium when loaded with deuterons or protons using a variety of techniques such as electrolysis, plasma discharges, or high pressure. While in its infancy, this phenomenon has profound and practical implications for the nuclear field. Some research is aimed at developing a new type of energy cell based on Low-Energy Nuclear Reactions, while other research is directed at ways to utilize the technique for radioactive waste management. With respect to the latter, experiments have been performed starting with natural uranium and thorium to seek reduction in the radioactivity.

A number of leaders in the area are participating in the sessions and will also be involved in the workshop. The workshop provides an especially good opportunity for ANS attendees to interact with the scientists involved in this novel research. Much of this work is not well known outside of a small group involved in the research, so these sessions offer a unique opportunity to find out the latest results and directions The two sessions on Transmutation and Isotope Production by Low-Energy Nuclear Reactions in Solids are scheduled for Tuesday, while the workshop is scheduled for Wednesday morning.

WORKSHOP ON TRANSMUTATION AND ISOTOPE PRODUCTION BY LOW-ENERGY NUCLEAR REACTIONS IN SOLIDS

This workshop is intended to provide interested ANS members with an overview of the field of Transmutation and Isotope Production by Low-Energy Nuclear Reactions in Solids. A panel consisting of key researchers in the field (John Fisher, R. A. Oriani, Mike McKubre, Yeong Kim, Talbot Chubb, Heinz Hora, Lali Chatterjee, Maria Okuniewski) will provide a brief presentation. Issues to be addressed include the present status of this research, the status of current theory, proposed new experiments, scale-up issues and possible future applications, including heat production and radiation ameliation.

Following the panel presentation, the workshop will be open to questions and comments from attendees. A demonstration cell will be run to illustrate the typical operation of a low energy nuclear reaction system.



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Nuclear AUGMENTED COMBUSTION Emerges...

IMMEDIATE and Substantial Reduction in Global Fossil Fuel Consumption and Pollution Is Now Possible with Lithium-Based Fuel Additive.

by Eugene Mallove

Imagine an abundant, simple fuel additive that could—if widely used—reduce global fossil fuel consumption dramatically. Imagine that this simple additive could also substantially reduce the emission of pollution from combustion processes — from power plants (oil, coal, natural gas), home heating units, gasoline engines, and diesel engines. Furthermore, imagine that using this additive required essentially no special retrofitting of existing boilers and engines.

Too good to be true? *Not at all!* This additive exists today and has already undergone extremely convincing testing over the past 10 years. The performance of the fuel additive is well documented in material associated with this article, provided by Crystal Energy, Inc., the licensee of United States Patent #4,668,247 (granted May 26, 1987) that is the basis for these claims. The Connecticut-based company, with facilities also in California, has filed new patent applications designed to improve both the triggering and control of this technology.

The Hungarian-American inventor of the additive, Dr. Szilard Berenyi, is now deceased (he passed away in 1994), but on September 25, 1985 he filed a U.S. patent application for a "Hydrogen Energy Releasing Catalyst." So important is this patent, that it has been reproduced in full in this issue of *Infinite Energy* (see pages 55-57). At the time of his filing, Berenyi had a company in Northvale, New Jersey, Fusion Aided Combustion Technology Corporation.

Long before Drs. Pons and Fleischmann made their announcement of "excess energy" in electrochemical cells in March 1989, Berenyi and others were observing substantial, unexplained excess energy releases in fossil-fuel combustion processes. More energy was apparently being released by the tiny amount of additive than could conceivably be explained by ordinary chemical reactions. Certainly, *few* in the fossil fuel industry then (*or perhaps now!*) were prepared to believe that such a simple additive could so dramatically increase the energy output of combustion devices! There is no precedent for this that has been so well measured as in the compendious data provided to *Infinite Energy*— a portion of which is included in this month's coverage of this amazing development.

Lithium-augmented combustion test, the first with indications of alpha-particle emission. Note the high-voltage reaction-triggering electrode penetrating the flame — from top left. (*Courtesy, Crystal Energy, Inc.*)

Berenyi's succinct patent abstract states: "A hydrogen energy releasing catalyst comprises a lipo-soluble organometallic lithium and a vehicle or diluent oil. A process for preparing the aforementioned catalyst, which comprises dissolving or dispersing a liposoluble organometallic lithium in a vehicle or diluent oil. A method of using the aforementioned catalyst which comprises adding it to a hydrocarbon fuel at a specified catalyst-to-fuel ratio according to the type of fuel and the combustion device used. In the case of a gasoline or diesel internal combustion engine, the mileage increases from 15% to 35%, while in a furnace or boiler the fuel efficiency increases from 20% to 35%."

Was there any connection between this technology having such a bold promise, and what cold fusion scientists have been doing these past nine years? Perhaps. After all, the common feature in many (not *all*) cold fusion experiments is the presence of a lithium salt. Certainly that is what Fleischmann and Pons started with (lithium deuteroxide). This continues as a key aspect of such excess energy cells as the Patterson Power Cell of Clean Energy Technologies, Inc. (lithium sulfate, Li_2SO_4).

However, the high temperature gaseous combustion flames involved with the lithium additive "Pyrium"—as Berenyi initially called it — would seem to have little to do with loading of heavy hydrogen or light hydrogen into metals.

When Harry Taplin, a highly qualified combustion and energy engineer, later became involved with the development of the additive, steps were taken to investigate possible nuclear aspects of the process. To the astonishment of all, significant evidence emerged that the lithium was somehow producing very detectable emission of alpha particles from combustion flames in a laboratory setting! A professor of chemistry at Berkeley, William Gwinn (now Emeritus and retired), was brought in to investigate.

Gwinn prepared a report for the Crystal Energy company that left no doubt that in his mind the evidence for the alpha emission was clear and decisive. We reproduce Prof. Gwinn's report in full on pages (23-24), courtesy of Crystal Energy, Inc. This part of the investigation —gathering the nuclear evidence— occurred in the early 1990s, at the time of the building attacks against cold fusion. There were many bigoted attacks against anomalous nuclear data by members of the physics and chemistry establishment. Thus, the company was at that time reluctant to disclose its findings and attract too much attention. So this nuclear emissions part of the project was mothballed.

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Thanks to an agreement to be completely open about this, the nuclear evidence will now be re-examined. Crystal Energy, Inc. is now turning over all its experimental apparatus to Cold Fusion Technology, Inc. in Bow, New Hampshire. We will reconstitute the test bed and using calibrated nuclear instruments, will attempt to verify—or reject—the nuclear evidence obtained in the early 1990s. Working with others who have greater experience with nuclear measurements, we hope to have a full report on our findings in Issue #19 or #20 this summer.

One of the theories that was put forth by Gwinn to explain the reaction had been a previously documented "hot fusion" reaction— a kind of "fusion chain reaction" involving a lithium nucleus and proton collision that yield two alpha particles (helium-4 nuclei). These helium nuclei were then imagined to collide with other hydrogens in the hydrocarbon flame, These accelerated protons (or deuterons, if heavy hydrogen was present), would then interact with other lithium nuclei to continue the chaining reaction. The reaction is fancifully depicted on the cover of this issue of *Infinite Energy*.

In the literature, there is nothing fanciful at all about such fusion chaining reactions—they have been discussed by fusion researcher J. Rand McNally, Jr. of Oak Ridge National laboratory.[1,2,3] However, it is admittedly a big stretch to conceive how these reactions would occur in a low temperature (low-temperature relative to multi-million degree hot fusion reactions) combustion flame. There is an enormous Coulomb repulsion between a bare proton and a lithium nucleus — shielded or unshielded by an electron cloud. For fusion to occur, the proton would seem to have to approach the lithium nucleus with high energy.

In fact, high-voltage triggering of the reaction was tested by Gwinn *et al*. with some success. Also, high energy particles from radioactive sources were used to provoke the supposed chaining fusion reaction.

There is no suggestion *here* that the reaction *must* be a fusion chain reaction. There is strong presumptive evidence, however, that the reaction might be nuclear based, for two reasons: (1) Alpha particles have apparently been detected by *two* scientists connected with the project (Dr. Gwinn, and an individual with training in nuclear instrumentation in health physics, Steve Walaski) and (2) When a computation is performed for the excess energy released in the combustion per lithium nucleus, a number consistent with a nuclear-level energy release is derived. The number found is on the order of 1 to 20 MeV—million electron volt —released per lithium, depending strongly on the assumption of how much lithium provided to the combusting fossil fuel actually participates in a nuclear reaction.

On request of this author, Harry Taplin provided test results and conditions from 1992-93 for three months of monitoring of an oil-fueled boiler at a South American power generating station. (The plant instrumentation was of US manufacture.)

The metered Output/Input efficiency of the power plant boiler was 99%, 100%, and 98% in each of three months—all *highly anomalous* results. Power plant boiler output/input efficiency is normally in the 83% to 87% vicinity for efficient, properly operating boilers. The output/input efficiency in this instance means that for the metered amount of fuel fed in, 83% to 87% of the pre-measured (by bomb calorimetry) chemical combustion energy content of the fuel is delivered to the boiler water. The rest of the heat energy is wasted in the energy loss of stack gases.

An important point that any knee-jerk skeptic should bear in mind: this energy loss — the heat-loss measurement made on the plant stack gases (dry gases and water vapor), is normally fully consistent (within 1%) of the output/input measurement. In other words: subtract the heat-loss measurement (say 17%) from 100% and get the experimentally measured 83% output/input value.

In the case where these anomalous 98% to 100% and higher output/input efficiencies are registered, there is thus a *real* excess energy that in this case was 12% to 14% above normal. There is little doubt that this measurement is valid to within a few percentage points. The graphs provided by Harry Taplin and reproduced on the following pages clearly illustrate this concept.

Now, lab analysis of the active species (Li) in the oil determined that it was present at 5 ppm (parts per million) in the oil. The average "excess energy" production determined *per pound* of Li was 3,750 x 10^6 BTU. This is a release of 61,000 MJ per mole, or 0.63 MeV per Li atom if all the lithium were reacted in a hypothetical reaction. If only 5% of the lithium were reacted, the energy release per *reacting* atom would be 12.1 MeV. It is suggestive that the ($^7Li + p \rightarrow 2\ ^4He$) reaction releases 17.3 MeV of energy.

Nuclear augmented combustion—whether or not it really is *nuclear* (and it is difficult to see how it could *not* be nuclear based on the data)—might well turn out to be the ultimate spin-off of the U.S. space program. You see, as a NASA employee many years ago, Dr. Berenyi received inspiration for his invention from witnessing anomalous energy releases in tests with the lithium compound canisters used to remove CO_2 from spacecraft cabin atmospheres.

References:

1. J. Rand McNally, Jr., "Nuclear Fusion " in *Encyclopedia of Chemistry*, 3rd Edition, Edited by Hampel & Hawley, 1973, VanNostrand Reinhold Company.
2. J. Rand McNally, Jr., "Fusion Chain Reaction Cycles in p + ^{6}Li Fuel," *Nuclear Instruments and Methods in Physics Research*, A271 (1988), pp.5-6.
3. J. Rand McNally, "Fusion Chain Reactions," *Nuclear Fusion*, (Letters), Vol.11, 1971, pp. 187-193.

There are several letters to Dr. Berenyi and Crystal Energy, Inc. that are anecdotally supportive of highly anomalous behavior of the lithium additive when used in boiler systems.

One came from Joseph A. D'Ignazio of Swarthmore, Pennsylvania (January 24, 1987). He wrote:

Dear Dr. Berenyi,

Per your recent request, I enclose a brief factual account of the operation of the powerplant during the testing of your fuel catalyst PYRIUM in 1976 at the Williamson School, Media, PA. As you know, upon graduation from the Power Technology curriculum I immediately accepted a start-up engineer's position with the Cleaver Brooks Co. in Milwaukee, WI. My responsibilities were to commission the watertube boiler systems manufactured by Cleaver Brooks on a national and international basis. Currently, I am employed with the Johnson Controls Co., Philadelphia, PA, as a Project Engineer responsible for execution of instrumentation and control contracts serving the Process Control markets.

The Power Technology curriculum consisted of the completion of associated technical studies and the operation at the powerplant located on campus on a daily 24 hour basis. In 1976, my senior year, I was assigned to assist you during your testing effort, of the catalyst PYRIUM.

The testing consisted of the injection of PYRIUM into the furnace of the boiler while it was on-line generating power for the electrical and heating requirements of the campus. I was responsible for the operation of the powerplant during your testing. Upon commencement of the testing, the powerplant behaved in a fashion that I had never experienced. Being a student, I could not scientifically explain the reasons for the powerplant's peculiar operation, but empirically I could verify without any doubts that the powerplant had never performed in the manner in which it did, and the cause of the powerplant's astonishing reactions were directly attributed to your testing.

Two incidents resulting from your testing shall always be with me. The first occurred in the evening

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during the time when evening classes were underway. We had completed the preliminary tasks and checks required prior to PYRIUM injection. The familiar electrical load from evening classes existed. The catalyst was injected into the boiler on-line. I proceeded to make the routine checks required in operating the powerplant, to take the pulse of the plant. You proceeded to check some measuring instruments that you had set up. Then I sensed *the firing rate had picked up*, although not visually observing a mechanical firing rate linkage change. The firing increase I observed was via sound. I thought nothing of it. I thought it was a minor load increase dictated by evening classes. It continued. This puzzled me. Past experiences of that type of electrical load wouldn't have continued to increase. Then suddenly the lights increased in brightness. Immediately, I knew there was a problem. I raced to the turbine deck and found what I had suspected. *The turbine was out of control*. Alternating voltage frequency was 62 cycles/second and climbing. I attempted to decrease the turbine's speed from the control panel, but the turbine did not respond. I then went to the turbine itself and manually lowered the setpoint on its servo control mechanism. The turbine stabilized. I distinctly recall after that incident, the turbine's throttle only required 80 psi saturated steam pressure at the *same load* requirements. We never ran the turbine at that pressure.

The second unexplainable observation was truly incredible. During testing, as a result of altering the catalyst/fuel oil ratio, *the actual physical size of the flame decreased*. The fuel oil input into the furnace decreased to the low fuel oil cutout setpoint and consequently the boiler shut down. This meant the turbine which was still on-line had to be manually taken off-line in order to divert the electrical load to another operational generator. However, *the electrical load was being maintained by the turbine*. I ran to the turbine deck to verify this. I then returned to the boiler to verify that *no flame existed in the furnace*, and there was none. However, an eerie pinkish hue existed in the furnace. I then went back up to the turbine deck, and the electrical load was still being maintained by the turbine generator. I returned to the boiler room and still no flame existed in the furnace. A decision was made to close the boiler's main steam boiler to conserve steam required for steam atomization of the fuel. The turbine was taken off-line and a diesel generator was put on-line.

I cannot scientifically explain how the electrical load was maintained without any flame in the boiler's furnace. I hope this correspondence is helpful in your pursuit for credibility of Fusion Aided Combustion.

Regards,
Joseph A. D' Ignazio

•••••••

Another letter came from William Bogosian, Superintendent of pumping and maintenance at Hackensack Water Company, Harrington, New Jersey, February 17, 1983,

Dear Dr. Berenyi:

The purpose of this letter is to give testimonial as to the effects of Pyrium "A" and "D" in the #6 boiler fuel oil at the New Milford Pumping Plant of Hackensack Water Company.

1. Stack gas analysis routinely shows excess oxygen levels in the range of 2 to 2.5% without any carbon monoxide or any visible smoke being present. This is a definite improvement over previously experienced levels.

2. There is also a decrease in water vapor in the stack gas. This gives credibility to your claim that hydrogen is being cracked to release its binding energies and is therefore not available to form water vapor.

3. Flame temperature was increased with a corresponding decrease in flame size. The net effect is to permit higher boiler loads without the flame impinging on the back wall.

4. After 31 years of operation, the boiler had decreased in efficiency from 80% to 70%. After testing with Pyrium, the boiler operated to reconfirm the baseline 70%. The boiler was found to have re-turned to its original 80% efficiency. A fireside inspection revealed that hard deposits normally associated with combustion over the years had disappeared from the normally inaccessible areas below the steam drum. These deposits that did remain were washed away easily with a water hose.

5. Most of the boiler brick in the firebox had become glazed. This indicates *an increased heat rate*.

6. Deposits on the tubes in the firebox area were light and flaky with no heavy accumulations. The tube cleanliness is similar to-that in gas fired units.

7. The capability of the boiler to operate steam equipment was raised from approximately *1545 MHP to approximately 3700 MHP* without a drop in plant steam pressure. Additional steam equipment load could not be placed on-the-line because the distribution system could not accommodate the increased output.

8. For a constant system pumping load, constant fuel burning rate, and constant steam drum level, the feedwater flow decreased. This condition resulted when the Pyrium temporarily reached its full flame activation temperature. This situation indicates a steam condition of supersaturation may be present. At this time, the confirmation of percentage of supersaturation cannot be determined because of a lack of a steam flow meter to compare the feedwater meter flow against.

In conclusion, it is my opinion that Pyrium has increased the boiler's, heat rate and decreased the amount of excess air needed to levels not consistent with normal combustion processes. I sincerely hope that your project be continued for at least a six week period with the additional use of a steam flow meter to investigate the role that supersaturation may play and to further fine tune the Pyrium injection system. Based upon the results of this additional testing, the Pyrium should be tested in a large boiler with higher flame temperatures to fully utilize the effects of the Pyrium.

Please keep me informed of your progress and feel free to contact me for any assistance.

Very truly yours,
William Bogosian
Supt.—Pumping
and Maintenance

Comment on this letter added (apparently) by Berenyi:

"Note: The designed Maximum Fuel Burning Capability of the Boiler was 360 gallons per hour, producing 1545 Mechanical Horsepower. Utilizing the ATOMIC energy of the hydrogen, the same amount of fuel produced 3700 MHP = 240 % the COMBUSTIVE Fuel BTU (calorific) and WORK Equivalent. (Note: the combustive and ATOMIC Heats of the Hydrocarbon Fuels COMPOUNDED!)"

••••••

Another testimonial letter, this from J.J. van der Veken, Manager, Terminal Maintenance and Repair, Amerada Hess Corporation, Woodbridge, New Jersey, April 12, 1977:

Dear Dr. Berenyi:

This letter serves to confirm in writing the test results of your Photochemically Stimulated Catalytic Combustion Additive which we allowed you to try for a short period in one of our boilers. Continuous graphic recordings proved the additive works:

1. Maximum fuel efficiency increase is indeterminable, as it appears it is contingent solely on the degree of increased heating safely acceptable to the burner's standard hardware.

2. Fuel savings was limited to an allowable 25%-30%.

3. Stack sulphur emission was reduced 75%.

4. Burner fuel oxygen demand was drastically reduced.

Note: added 1. "Burner's Standard Hardware" means: 'BOILER'

•••••••

And yet another letter, this one from two instructors at Bergen County Vocational Technical High School, Hackensack, New Jersey (no date on the letter, but it is presumed to be in the late 1970s):

TO: Dr. S. Berenyi

FROM: F. M. Steingress
Sr. Instructor Stationary Engineering
Bergen Tech.

H. J. Frost
Instructor, Gold Seal
Bergen Tech.

SUBJECT: Review Test Data Re: Photochemically Stimulated Catalytic Combustion

We have reviewed the data you have gathered from your various combustion catalyst test[s] over the past three years.

The test results reflect several nonlinear deviations from the standard hydrocarbon combustion and thermodynamic laws.

In most instances there was a substantial increase in the heat rate with decrease in excess air, not accountable for in a normal combustion process.

Data indicates that normal thermal efficiencies were exceeded with a positive reduction of excess air. Test[s] also indicate that by increasing the fire rate with no increase in air flow, higher levels of oxygen were present in the combustion chamber.

The combustion efficiencies obtained cannot be accounted for in normal hydrocarbon combustion.

Test procedures proved that existing hardware could be used without experiencing any unusual difficulties.

The increased heat release not credited to the normal combustion process shows an increase in internal energy (possibly due to the release of photoelectric energy produced by the catalyst).

This increase in furnace temperature causes a change in the steam's specific volume. This produces a supersaturated rather than a saturated steam. Supersaturated steam is known to exist in nuclear power reactors.

In our opinion the catalytic combustion process apparently has produced a significant increase in the generated heat rate and heat transfer not accountable either to standard combustion from hydrocarbon fuels. Increased firing rate with no increase in air supply produced increased O_2 in the flue gas, thereby allowing a reduction in excess air.

We sincerely hope your product will contribute much in the solution of the fuel problem. Please keep us informed of your progress and do not hesitate to contact us if we can be of further assistance.

"To live effectively is to live with adequate information."
Norbert Wiener

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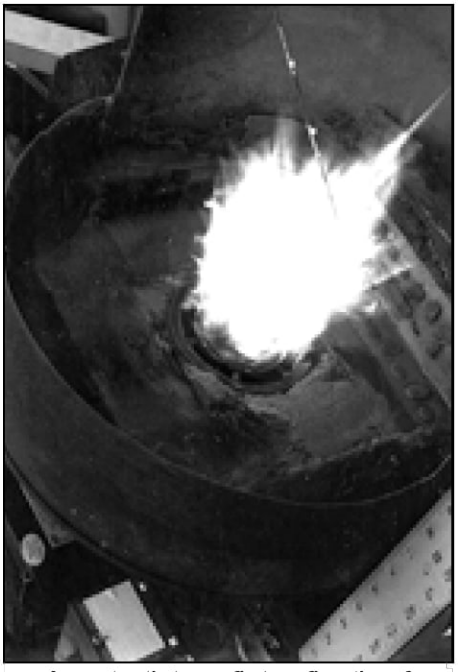
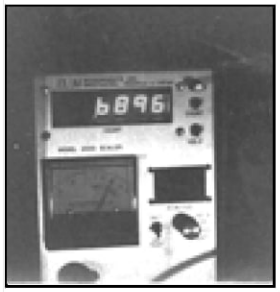


Apparatus that gave first confirmation of alpha-particle production. Note high-voltage electrode. (*Courtesy, Crystal Energy, Inc.*)

Ludlum Proportional Counter and Scaler used for counting combustion flame alpha emissions in outdoor tests. (*Courtesy, Crystal Energy, Inc.*)

Photo showing water cooled copper "shoe" made to fit over alpha particle proportional counter detector near combustion flame. Opening in copper shoe is 0.5 cm x 4.0 cm (*Courtesy, Crystal Energy, Inc.*)

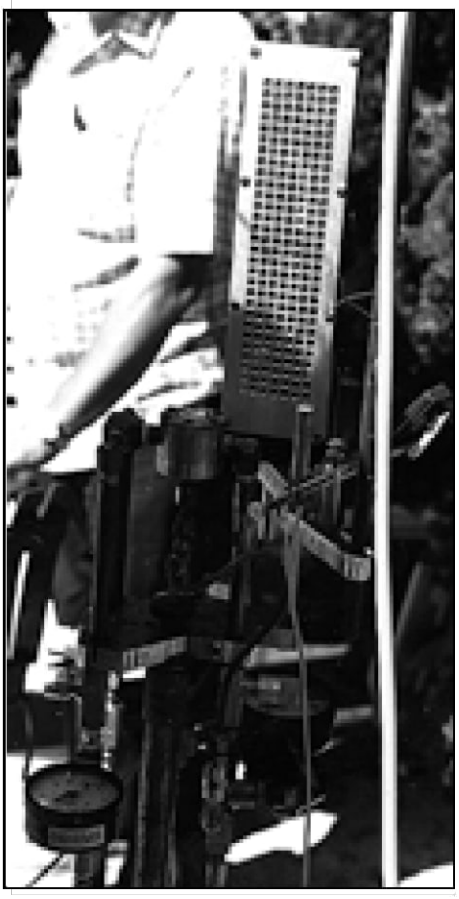


(LEFT) Prof. Gwinn had just finished a short test run after sunset. The alpha count for the experiment is shown on the counter. A first look at alpha count activity in this range. (*Courtesy, Crystal Energy, Inc.*)

(RIGHT) Initiating the reaction in October 1989 with high voltage electrodes. Copper detector cooling "shoe" is visible with pipe containing cooling water. (*Courtesy, Crystal Energy, Inc.*)

(LEFT) Two augmented combustion test stands used in 1989, left in background and in foreground. (*Courtesy, Crystal Energy, Inc.*)

(RIGHT) Early apparatus for measuring alpha emissions from gas flame fed by lithium additive. (*Courtesy, Crystal Energy, Inc.*)



(LEFT) Early test apparatus developed in October 1989. Pictured: Steven Walaski, a professional who worked in radiation measurements for the U.S. Navy and hospitals. He held a master's degree in radiation measurements, i.e. health physics. (*Courtesy, Crystal Energy, Inc.*)

AUGMENTED COMBUSTION:

A Brief History and Assessment

by Harry R. Taplin, PE, CEM Crystal Energy, Inc.

"The promise of this new technology - the propagation of a nuclear reaction through proton excitation in the vapor phase — is one of almost limitless energy with no nuclear waste products, no long range effects, no gamma ray or neutron creation, and no residual radioactivity. The theoretical energy from this reaction is approximately 10 billion BTU's per pound of active species. There is both scientific precedent and reproducible experimental data which strongly suggests that this can be achieved." [10 billion BTU's is equivalent to about $50,000 worth of diesel fuel]

"Based on the experiments run to date, a cause-effect relationship has been established between the presence of the elements of augmented combustion process and "Extra Energy" measured during testing of boilers, diesel engines, and gasoline engines. "

"Many additional tests have been run, some showing the extra energy phenomenon and a few not showing any change. Laboratory experiments with instrumentation to detect the subatomic reactions involved have from time-to-time shown *tremendous bursts* of the energy-producing reaction. Much time has been spent in futile attempts to reproduce them also. This is considered a learning process; if testing continues, sooner or later we will learn to predictably control and harness the reaction."

"Successful experiments have been performed with a combustion zone the size of a candle's flame as well as in boilers the size of a large building. Its amazing. What we have here is a full-blown subatomic, chaining reaction the size of candle flame."

SUMMARY: This is a report of intensive investigations into a family of phenomena which appear to provide anomalous augmentation in the energy output of standard combustion processes.

Crystal Energy, Inc. became involved in this technology when responsible and independent engineers in different settings witnessed large energy releases not explained by standard combustion theory and affirmed their conclusions to us. The first instance occurred in a university power plant setting; the second in an auxiliary power plant of a utility. The engineers attested to the phenomenon but also to its unpredictability and apparent randomness.

In-house experimentation was begun in 1988 and known science was researched for possible explanations of these results. That search was successful in two ways: (1) a possible scientific precedent was identified to explain the phenomenon and to provide a specific reaction of the component elements to evaluate and (2) when tested, the reaction was reproducible in the laboratory.

Although commercial application of augmented combustion may be possible right now in selected venues, full exploitation of this new technology requires further development of the theoretical basis of the phenomenon and the development of the means to initiate and control the reaction which is occurring.

Based on findings to date, there is every reason to believe that augmented combustion now offers a very limited opportunity for abundant, low cost, low pollution energy with minimal or no harmful effects to people or the environment. Crystal Energy has been supported in this effort to date by a group of private investors, but recognizes that investment by a broader group of interested parties will be necessary to exploit the full potential of this technology. We well appreciate the value of co-venturing with organizations with the resources and expertise to resolve the challenges and develop the opportunities ahead.

There is an acute awareness of the conflicts and criticisms that "cold fusion" caused several years ago, which apparently promises to continue for some time. Accordingly, we had been very reluctant to disclose our findings and attract a similar level of attention which would surely have detracted from orderly research and management of the project. It is felt however, that we have sufficient theoretical support and good reproducible experimental evidence to convince any reasonable and genuinely curious investigator that the findings to date are significant and hold great promise for the future.

BACKGROUND AND HISTORY

The first observations of augmented combustion occurred on a NASA test-bed during the 1960's when a project engineer witnessed a melt down of a test apparatus which involved more energy than could be accounted for in the conventional combustion of the materials involved. [Editor's note: This involved systems in which *lithium* compounds were present.—EFM] This occurred at the time that funding was being withdrawn from the space effort. The engineers and scientists involved were forced to seek other employment, bringing to an end the opportunity for further investigation. Some time later this same engineer witnessed another instance of the same phenomenon during another experiment. These events led to an investigation of the possible causes and a series of tests was undertaken to understand what was occurring. This eventually lead to testing of combustion applications including boilers, gasoline-driven vehicles, and diesel engines.

Starting in 1976, tests were conducted at various boiler plants to study and document the reaction. This testing program had a significant handicap. Conventional boilers with years of hard use, neglected maintenance, and poor instrumentation were used. The test documentation was supported only by existing plant instrumentation except for exhaust gas analyzers brought to the plant for the tests. The test procedure did not follow existing codes for boiler testing. This was not the type of test-bed that the scientific community would accept for evidence, so the project languished from lack of acceptance or backing by anyone in a position to finance or perform independent scientific investigation and experimentation.

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In spite of these flaws, supervisors and engineers at these plants, with good qualifications and long years of experience with their equipment's performance, were willing to attest to the fact that they had witnessed improved efficiency, increased output, and reduced pollution.

It is unfortunate that a fully instrumented and calibrated scientific test-bed could not have been used for this testing, because we have four independent reports of tests conducted at different locations that show a similar pattern in the results. These results include fuel savings, (in two tests close to a 30% improvement was indicated), decreased pollution, and the ability of boilers to produce significantly higher output. In one case the mechanical power output of steam driven pumps increased from 1,545 to 3,700 horsepower with no loss of system steam pressure or additional fuel.

Over several years, extensive research has been conducted into the possible physics of a high energy release. This research identified several nuclear level reactions which were candidates for producing or triggering the high energy yields. The theoretical findings were taken to the laboratory and the identified nuclear level reactions were reproduced in a gas flame. Based on our findings, there is confidence that the main reaction produces no residual radioactivity and even without shielding it is difficult to detect any radiation a short distance from the reaction zone. If one does not come into direct contact with the hot flames, one is safe from the reaction. If one does contact the hot combustion flames, then exposure to the reaction would be academic in view of the severe burns one would normally experience.

From this starting point, we intensified our research to build our knowledge and experience.

THE TECHNOLOGY

While the technology in the specific form under development is new, the basic reaction was discovered in the 1930's and is part of scientific literature. The application of this process to standard combustion was somehow overlooked all these years until we began our efforts.

A particularly important feature of the discoveries is that there is apparently a dual temperature environment. There is one set of chemical reactions operating at the temperature of a typical combustion flame and a second set of reactions, thought to be nuclear in nature, operating in the temperature range of millions of degrees C. With the proper ratios, these two reactions can occur in the same zone and device (such as conventional combustion processes) and take advantage of the high energy yield of the reaction without the risk and cost of specialized equipment. Using the vapor phase provided by small burner assemblies we were able to measure energy events beyond 200 KeV, which represents effective temperatures in the range of millions of degrees.

Further research is needed to gain a comprehensive understanding of the process producing the "excess energy" phenomena. Investigation of the process with state-of-the-art instrumentation, while the reaction is in progress, should yield significant information on producing much higher energy yields. Research on this project to date has produced what we believe to be the actual large energy producing reaction, indicated by the chaining reaction detected by our laboratory instruments and demonstrated in the boiler heat balance experiments.

POTENTIAL BENEFITS

With this technology, there is the potential to tailor applications in a variety of directions governed by species concentration, initiation means, and reaction chamber configuration. It has become obvious that there is a broad range of applications in fossil fuel burning processes. An intriguing feature of this technology is that it can be made to work in almost any combustion environment. This process has produced results in internal combustion engines and probably can be engineered to work in gas turbines as well. There may be whole new classes of equipment and applications that evolve from this basic energy reaction. A long list of applications is envisioned with very attractive practical and economic benefits. *Firing with fossil fuel may not be necessary for future hardware.* Currently the means of developing the reaction provides a convenient entrance point to early commercialization.

Unlike most present power generation systems, this new technology is non-polluting itself while reducing pollution significantly in boilers and internal combustion engines. Theory and testing to date indicate absolutely no measured radioactive waste or emissions.

RESEARCH PROGRAM

The research program is keyed to three targets:

Harry Taplin. Photo taken in Vilnius, Lithuania on a project for the Swedish ambassador and The World Environmental Center (*Courtesy, Crystal Energy, Inc.*)

HARRY TAPLIN, P.E., C.E.M.,
is an expert who has over 30 years' experience in boiler operations, design, testing, and troubleshooting. A nationally recognized authority on boiler efficiency improvement, he has managed a worldwide boiler tune-up program involving hundreds of plants and thousands of tests - identifying more than $7 million worth of plant deficiencies and saving millions of gallons of fuel per year. He holds an unlimited steam engineer's license and has had extensive factory training in control systems. For the past 15 years he has been troubleshooting plants, conducting efficiency tests and evaluations, developing test instrument packages, and designing training programs for plant operators, supervisors, and managers. He earned his B.S. degree at the U.S. Coast Guard Academy. Mr. Taplin was President of the Association of Energy Engineers in 1995. He lectures extensively for the ASME, AEE and other organizations on Combustion and Power Plant Optimization. This takes him to all corners of the world— to countries such as Kuala Lumpur, Saudi Arabia, and India. He has written two books on Optimizing Plant Performance and Combustion Efficiency. He has three Professional Engineering Licenses.

A. The first target area is credibility. Credibility must be established in terms acceptable to both the scientific and commercial communities.

B. The second target area is a fuller understanding of the parameters of the reaction envelope. Means of calculating and understanding the effects of increased amounts of the active species, hydrogen, and moderating species in a reaction zone must be determined.

C. The third target is proof of economic feasibility which demonstrates a bottom line energy gain and pollution reduction.

EARLY EXPERIMENTS

The anecdotal information we started with pointed to investigation of combustion processes. Additionally, we reasoned that the highly active vapor phase of combustion would be an ideal environment to disperse the active species with high probability of the desired reaction.

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Early experiments with an open flame had demonstrated conclusively that alpha particles were being produced. In these informal experiments we found that a sheet of paper could block the high energy particles. Subsequently, the production of alphas (helium nuclei) was measured and confirmed (by a radiation specialist with a masters degree in the subject) using calibrated laboratory grade alpha detectors.

TABLE 1.

Particle Energy (KeV) [Ranges explored]	Number of Events [Measured over several minutes]
8 - 304	155,469
304 - 800	1,542
800 - 1,600	18,663
1,600 - 3,200	20,432
3,200 - 4,000	4,950
88 - 4,088	110,850
504 - 1,104	19,603

Note 1. *Detector shielding included a water cooled copper cover, copper screening and a capton sheet. Measurements taken through a water cooled port 0.5 by 4 centimeters located about 2.5 centimeters from the flame front.*

A bench-top apparatus was then designed and used to demonstrate and explore the reactions in progress. It was used along with a special air proportional alpha detector, scaler, and computerized analyzer to indicate to us the exact count of high energy events in selected ranges. It was used to detect and record results similar to Table 1. It is noted that the equivalent temperatures corresponding to the energy ranges are in the millions of degrees, which argues with the term "cold fusion." This finding gave rise to speculations as to the nature of the dual-temperature reaction environment and the expectancy that with more work reaction chambers could be produced independent of any fossil fuel environment. Like kindling wood used to start a fire in the fireplace, fossil fuel combustion processes just serve as a convenient way to get the reaction started and as a means to sustain the reaction.

TABLE 2.

Detection Ranges
(Explored to 920 KeV)

Distance of Detector from Flame Front (cm.)	Number of Events (60 sec. interval)
6.0	1
5.5	14
4.5	360
4.0	3,653
3.5	781,680
3.0	650,111
2.5	66,645

Many experiments were conducted in late 1989 and early 1990. One such experiment shown in Table 2, explored the production of alpha particles and their detection relative to distance from the flame front.

The variance in distribution of detected events is believed to be caused in shifts in flame front position as it was moving around slightly. Another suspected variable during the experiment was the concentration of the active species in the reaction zone, caused by a build up of an obstruction in the feeder device.

In both experiments shown in the Tables 1 and 2 above, the same heavily shielded detector was used which undoubtedly blocked a substantial number of events from being detected through the very small [0.5 cm x 4 cm] window. A water cooled jacket had to be used along with copper screening and additional Capton heat shielding. Because of this, the total flame zone activity is presumed to be many magnitudes greater than indicated in Tables 1 and 2 above.

Unfortunately, this laboratory was closed in 1990 when our investors were informed by a noted professor, who was consulting to the project, that our laboratory findings notwithstanding, conventional quantum mechanics did not support the probabilities of a chaining phenomenon. He made these statements without reference to the elevated levels of alpha counts in the laboratory experiments which he had both observed and previously explained [*Editor's Note: Please see attached report.—EFM*]. In the furor attending the "cold fusion" controversy at that time, a conservative position on the part of financiers and academics is easily explained.

In another instance, hot fusion experts were brought in as consultants to review our work to see if we had found anything significant. They indicated that the reaction we were investigating was well known and explored, leading us to believe that the "establishment" had already researched this ground thoroughly— owing to the billions of dollars they had spent on research in the many institutions that had specialized in this field of investigation for decades.

Remaining unexplained were the many observations by competent engineers who had perceived and measured improvements in energy production and lower pollution levels. This and the fact that a patent had been issued did not let the matter rest easily in the minds of the primary investigators.

THE BOILER TESTING PROGRAM

Fortunately a boiler testing program had been on-going for about a year at the time support was withdrawn from the laboratory research. This time we were using a highly instrumented unit. The results of this program are illustrated in figures 1 – 7. These tests consistently produced "excess energy." Even these excellent results failed to attract either interest or comment from the scientific establishment when brought to their attention in conjunction with our laboratory findings.

The purpose of this boiler testing program had been to provide documentation of "Extra Energy" produced by this unusual energy reaction thought to be subatomic in nature. The starting point was a number of unusual incidents of improved efficiency, increased capacity and reduced pollution observed by qualified engineers going back to 1976 and before. Observations of this type are often devalued by lack of instrumentation and scientific procedure, which was true in this case also. However, there was an intriguing consistency in the independent reports.

The term "Extra Energy" was interpreted by several critics as contradictory to conventional science, particularly in view of the First Law of Thermodynamics, which states basically that energy can neither be created nor destroyed. Science also recognizes that large energy potentials exist on the nuclear and subatomic level when transmutation and other events take place, so we now speak of mass/energy conservation. The First Law (energy conservation) in its most general form deals with heat and work occurring as a result of chemical or nuclear reactions. The boiler testing program provided important evidence of "extra energy" in terms of heat and work coming from the subatomic level or from some mechanism yet to be discovered.

The boiler testing program has been on-going since 1988 with significant 'Excess Energy" being measured in many different types of plants. Figures 8 – 15 show general results of the testing.

AUTOMOTIVE TESTING PROGRAM

In 1991 we joined forces with a company working on a Reformulated Gasoline project. The included report documents the results of this work, during this period our fuel additive went under the name of EXZITE. Most of our work was done at the Pittsburgh Applied Research Center (PARC) using a new GM engine. Some very good results emerged from the data.

During 1994-95 The South Coast Air

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Pollution Control District [SCAPCD] provided us a grant to test the fuel additive in modern gasoline vehicles. A huge amount of data was produced during this program with over 100 automotive tests using Federal Test

Procedure [FTP] protocols were carried out at a leading auto emissions laboratory in southern California. Significant improvements were produced in lowering carbon monoxide and hydrocarbon emissions. Almost all vehicles had modest improvements in gas mileage, but we need to work more on this area. Our results were thoroughly documented and statistically analyzed by a professor of mathematics retained from the University of California, Irvine. Statistically significant improvements in both emissions and fuel efficiency were identified.

For reasons unknown, the results never drew comment or curiosity from the SCAPCD committee monitoring the project. I did get a comment relayed to me that was reported to have come from a Ph.D. connected with the program: "It is impossible to improve vehicle performance with fuel additives and this had all been thoroughly investigated in the past with no results."

Another vehicle program at the same automotive emissions laboratory, involving steady state dynamometer testing, produced extraordinary reductions in pollution levels using the fuel catalyst. One interesting development was a 400% and a 700%, increase in oxygen in the engine exhaust, which is yet to be explained. This laboratory also manufacturers emissions monitoring equipment. Their technicians set up the test equipment and kept it calibrated during testing, so we have high confidence in the results, which are well out of the range of possible instrument error or drift.

HEAVY DUTY DIESEL TESTING PROGRAM

The heavy duty Diesel program produced results consistent with the boiler and automobile testing programs. Using well instrumented heavy duty Diesel engine dynamometer test stands, varying degrees of improved fuel economy and reduced NO_x emissions were recorded using three different engines. During another test using a chassis dynamometer, a 30% reduction in NO_x was achieved using a Diesel powered truck. The power requirement was set at 180 hp. This horsepower range represented the power required to move a mass of 80,000 lbs at a speed of 60 miles per hour with 5 axles on an asphalt surface. A 13 mode test conforming to 40 CFR 86.336-79 specifications was used, however the typical 6 minute modes were lengthened to 30 minutes for higher accuracy.

Combustion Breakthrough

Over Ten Years of Testing —Certified Results

Boilers

- Exceptional, *higher than theoretical*, efficiency levels produced — 5% to15%
- Pollution reduced

Diesel

- Fuel economy improvements range from 7% to 12%
- NO_x reductions to 30%

Automotive*

- CO reductions—16%
- Hydrocarbon reductions — 8%
- Consistent 2% miles per gallon improvements

** Statistically significant*

BOILER RESEARCH PROGRAM

The purpose of the Boiler Research Program was to provide scientific documentation of efficiency improvement and pollution reduction caused by a new combustion discovery activated by a fuel additive. We needed to either prove or disprove the mystery of how boilers could exceed theoretical energy output with lower pollution levels. This report is a summary of our investigation.

For the first series of tests, a hot water boiler was instrumented to a high degree of accuracy and repeatability. The test boiler's design, instrumentation and performance was checked out by two qualified engineers to insure accurate test results. Scientific grade instruments were used for flow measurements and special precision thermocouple arrays were fabricated and calibrated for the testing program. The ASME/ANSI Boiler Test Code (4.1) was used as the basic guideline for the testing program. Calculation methods were verified by two boiler testing experts, one with a Doctorate and the other with a Masters degree, both having extensive experience in the field of boiler performance. Diesel and distillate grade fuels were used for most of the tests with this boiler. Fuel and catalyst mixtures were tested by the Engineering Department at Texas A&M University for Higher Heating Values (HHV). All calculations were performed using these precise laboratory values.

Figure 1 shows the calibration test for the laboratory boiler. Test bed accuracy was confirmed by comparing **input-output** efficiency and **heat-loss** efficiency which had an agreement of one percent or better for a three-hour test with no unexpected efficiency deviations. During the last two and a one-half hours of this calibration test, the **input-output** efficiency and the **heat-loss** efficiency varied by only 0.12%. This excellent performance confirmed that the test bed was indeed accurate and stable.

Figures 2 through 8 illustrate some of the test results with this boiler using the fuel additive. The reference or normal efficiency, heat-loss efficiency, was established by accurately measuring the standard boiler losses during the test. The heat-loss efficiency changes over time because of different excess air settings different firing rates and differences in exhaust temperature so it serves as a good datum to establish the normally expected performance. The *actual* energy produced by the boiler is shown as output/input efficiency on the various figures, this is a true measurement of the energy produced by normal combustion and the [new] energy reaction. This output/input efficiency is usually lower than heat-loss efficiency, but it was clearly higher during the tests, confirming the an unusual energy production reaction was taking place.

Figures 8 through 14 feature field test results in several large boilers, an electrical generating facility in South America, a large refinery in the US, a European chemical plant, and a water pumping facility. In all cases, well instrumented boilers indicate extraordinary efficiency with a special composition in their boiler fuel. Figure 15 indicates boiler NO_x reductions achieved.

Results on next four pages from:

Crystal Energy, Inc.
733 Summer Street, Suite 501
Stamford, CT 06901-1019

Phone: 203-348-8498
FAX: 203-348-3138
mikebl@erols.com

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"Pyrium" Logo used originally by Dr. S. Berenyi for his catalyst

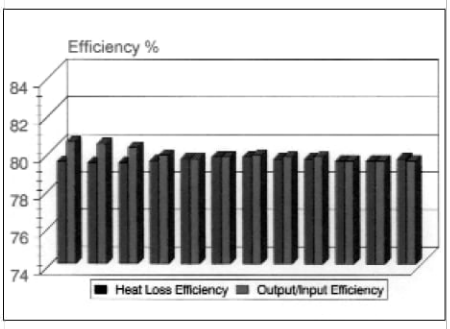


Figure 1. This graphic shows the accuracy and repeatability of the test boiler. It compares the calorimetric balance [Output/Input] to very accurate measurements of "Heat Losses." This is how the following tests should look without the use of the combustion catalyst.

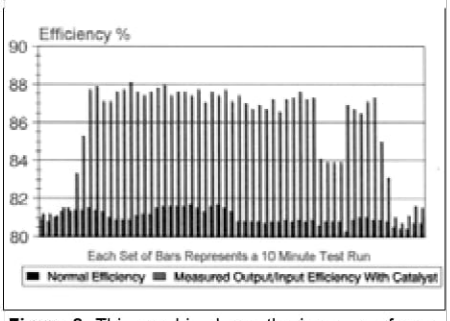


Figure 2. This graphic shows the increase of measured energy output caused by the catalyst compared to the normally expected efficiency without the energy reaction caused by the catalyst. The catalyst was not used at the beginning and end of the test series where the output/input efficiency closely matches heat-loss efficiency.

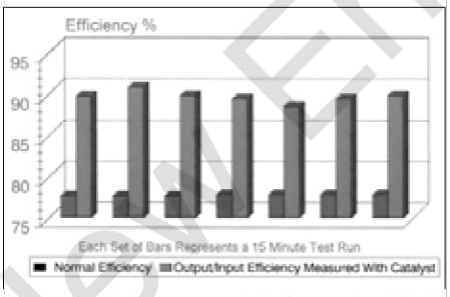


Figure 3. This is the second of a long series of tests demonstrating the increase of measured energy output above normal levels using the combustion catalyst.

Figure 8. (RIGHT) The design efficiency of this boiler was 87% when new many years ago. It was equipped with excellent metering and a computerized data acquisition system. Note that 10 monthly efficiency averages are above the design efficiency and nine monthly averages show normally expected efficiencies. The plant burned heavy residual fuel oil and provided steam for a 100 MW turbine-generator set.

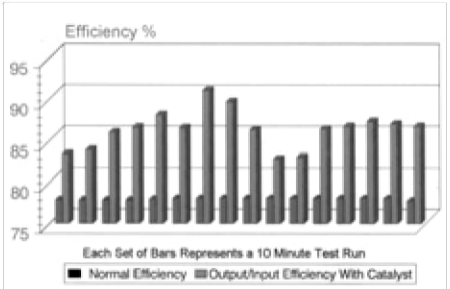


Figure 4. This is the third in a series of tests showing an increase of measured energy output above normal levels using the combustion catalyst.

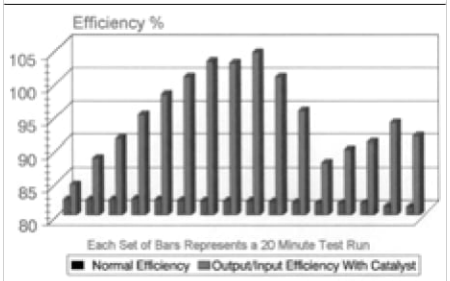


Figure 5. This is the fourth in a long series of tests showing the increase of measured energy output above normal levels using the combustion catalyst. In this case the measured results *appear* to defy the first law of thermodynamics (*unless a non-chemical source of energy is active*).

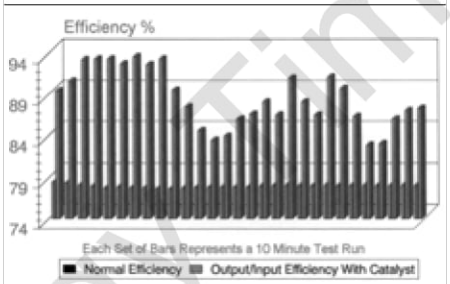


Figure 6. This is the fifth in a series of tests showing an increase of measured energy output above normal levels using the combustion catalyst.

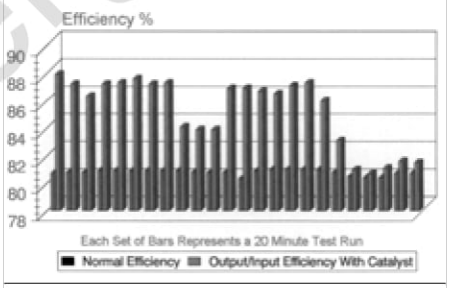
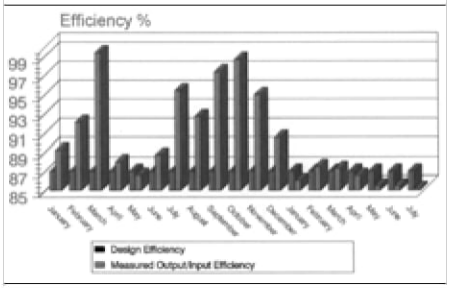


Figure 7. This is another in the series of tests demonstrating an increase of measured energy output above normal levels using the combustion catalyst. In this case the output input efficiency drops to near normal for the last five test runs.



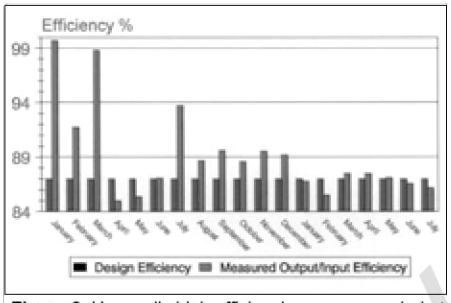


Figure 9. Unusually high efficiencies were recorded at other boilers at the same plant during the same months as the boiler in Figure 8. This is an example. Fuel analysis confirmed the fuel catalyst was active in the system serving these boilers.

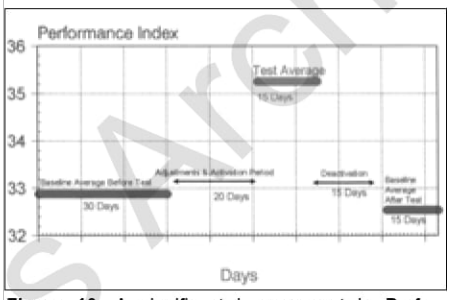


Figure 10. A significant improvement in Performance Index [steam generated/fuel burned] was demonstrated over a 15 day test period for this large industrial boiler at a major refinery. The basis of comparison for the efficiency improvement was a 20 day operational baseline before the test and another 15 day baseline after the test. The boiler was fully metered and automatically computed the performance index 96 times a day for the daily average.

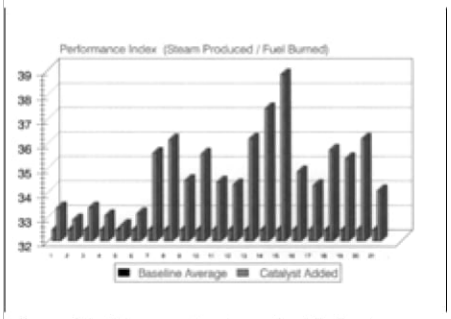


Figure 11. A large natural gas fired boiler improves its performance index [steam produced/fuel burned] with the combustion catalyst. This data is based on control room readings every 2 hours. The baseline index for 22 days was 32.45 with a high of 33.3 and a low reading of 31.6.

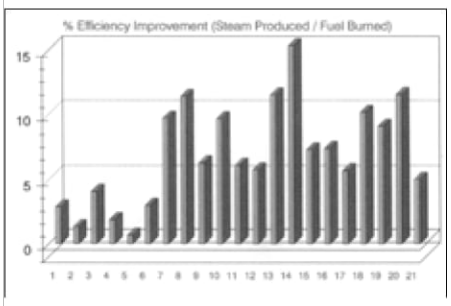


Figure 12. This figure shows the data of Figure 11 in terms of efficiency change. This boiler had an efficiency improvement of 5% to almost 15% compared to a 22 day baseline immediately before the test. The boiler returned to baseline operation a week or so after the catalyst injection stopped.

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European Chemical Plant

Fuel Type "Distilled Anthracite Oil"

- Fuel Savings 10%
- NOx Reduction from 355 PPM to 20 PPM

Figure 13. Testing conducted during 1991 at a chemical plant in Spain using distillation products from coal/coke processes for boiler fuel.

Hackensack NJ Water Pumping Station

Fuel Type "NO. 6 Fuel Oil"

- Fuel Savings 25%
- Side effect, removal of long term slag deposits from inaccessible areas.

Figure 14. Testing done over several months in the 1980s at an "old" boiler plant burning residual fuel oil. The maintenance staff was impressed with the cleaning effect produced during the tests.

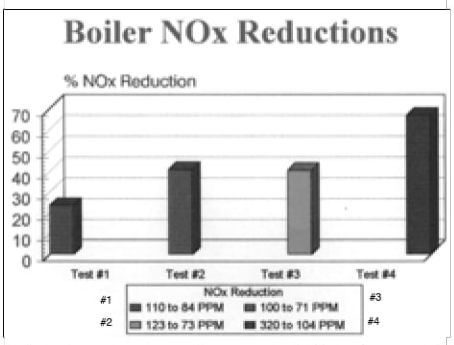


Figure 15. A series of tests with distillate fuel at different firing rates with relatively constant excess air levels produced significant reductions in Nitrogen Oxide emissions.

GASOLINE VEHICLE AND HEAVY DUTY DIESEL RESEARCH PROGRAM

The purpose of the automotive testing program was to provide scientific documentation of reduced emissions and improved fuel consumption using a new fuel additive linked to a combustion discovery. Testing was done at various recognized combustion laboratories in the US and Canada. The South Coast Air Pollution Control District (SCAPCD) provided a grant for a large number of automotive tests using Federal Test Procedures (FTP) protocol. Engine dynamometer tests were conducted at the Pittsburgh Applied Research Laboratory (PARC). Tests using state certified smog stations were conducted in California and Pennsylvania.

Automotive testing program results are shown in figures 1-7. It is quite obvious that the catalyst produced significant pollution reductions while increasing fuel economy in all vehicles during FTP testing.

Figure 8 shows the results of one of the engine dynamometer tests at PARC. Carbon monoxide and hydrocarbon emissions were reduced dramatically while fuel economy improved at all load ranges.

Figures 8-15 illustrate the results of steady-state chassis dynamometer testing. Results consistent with the FTPs and engine dynamometer testing were achieved. Figure 15 summarizes this test series with carbon monoxide reductions over 90%.

Test results using state certified smog stations are shown in Figures 16-18. Typical older off-the-street vehicles were used in their as-found condition. Once the test sequence began, no repairs or adjustments were made to these vehicles. This series of tests produced significant pollution reductions consistent with other program testing.

Throughout the testing program, laboratories and facilities were used which were represented to be either recognized or inspected by agencies such as the EPA, the California Air Resources Board and the SCAPCD to produce the most creditable results possible. It was very rare that positive and significant test results were not achieved during this multi-year program.

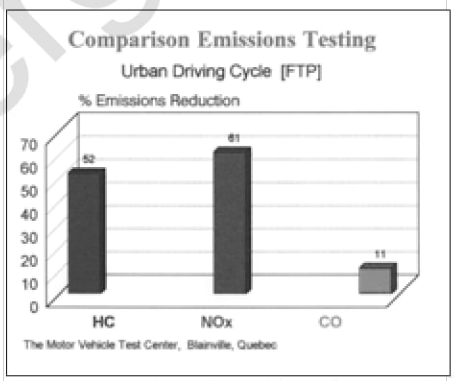


Figure 1. Comparison urban driving cycle test results using a 1992 Ford Taurus. Testing was done in accordance with the Canadian/US Environmental Protection Agency (EPA) standard test procedures by Transport Canada. The results shown are the average of two test series. Emission reductions were quite significant

Figure 5. (RIGHT) FTP tests compare pollution reduction effectiveness of oxygenated gasoline with and without the combustion catalyst. All vehicles had standard emission controls. The catalyst formula was consistently more effective at reducing hydrocarbon emissions.

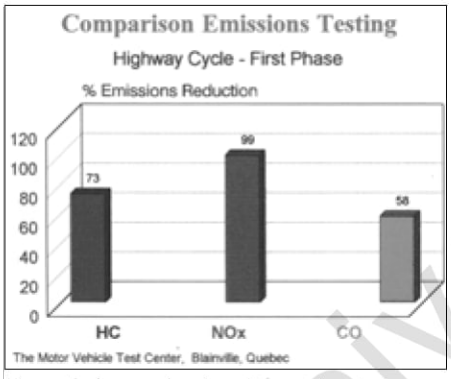


Figure 2. A second series of comparison tests conducted at the Motor Vehicle Test Center in Quebec using the first section of the FTP Highway Driving protocol. Nitrogen oxide reductions were quite extraordinary.

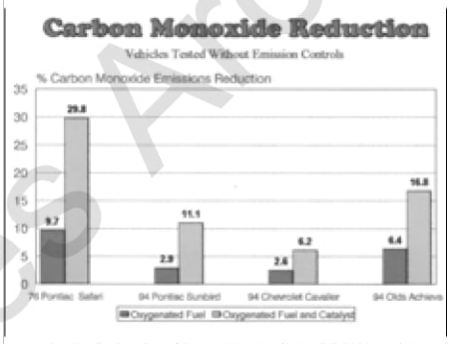


Figure 3. A Federal Test Procedure [FTP] testing at a recognized California laboratory, funded by a special grant managed by the South Coast Air Pollution Control District [SCAPCD], compares carbon monoxide reduction of a standard oxygenated fuel with and without the catalyst. For vehicles without emission control systems, the catalyst appears to be at least twice as effective as the oxygenated fuel alone.

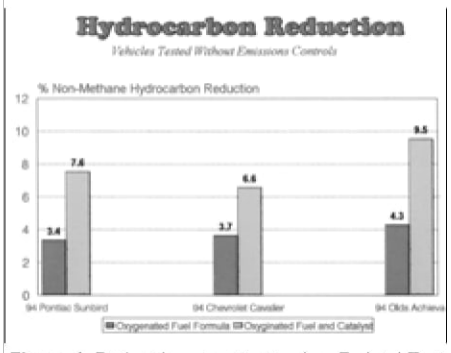
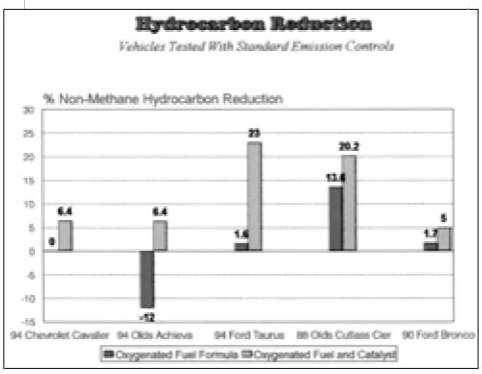


Figure 4. During the same test series, Federal Test Procedure [FTP] tests are used to compare the pollution reduction effectiveness of a standard oxygenated gasoline with and without the combustion catalyst. Results show the catalyst produces a superior result when controlling raw engine hydrocarbon exhaust emissions.



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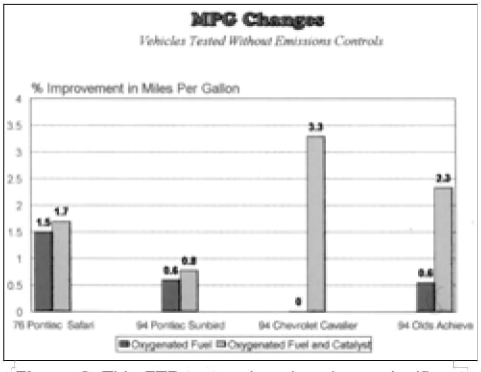


Figure 6. This FTP test series also shows significant and consistent mileage [MPG] improvements with fuel containing the combustion catalyst for vehicles without standard emissions controls.

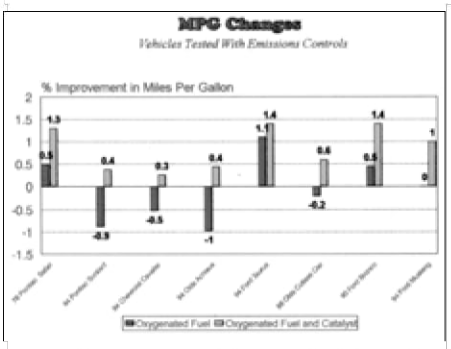


Figure 7. This series of Federal Test Procedure (FTP) tests disclose a small but significant increase in MPG in all vehicles with standard emissions controls.

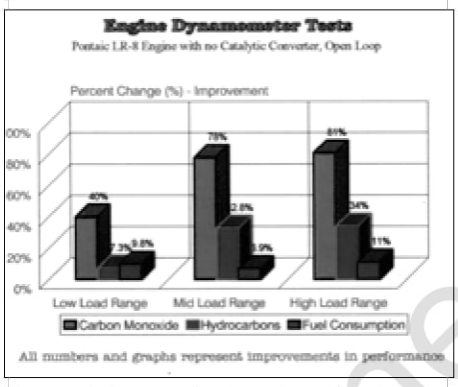


Figure 8. Many engine dynamometer tests were conducted at laboratories in California and at the Pittsburgh Applied Research Lab. Good results were usually obtained. This typical test result shows significant pollution reduction and fuel efficiency improvements at all test loads.

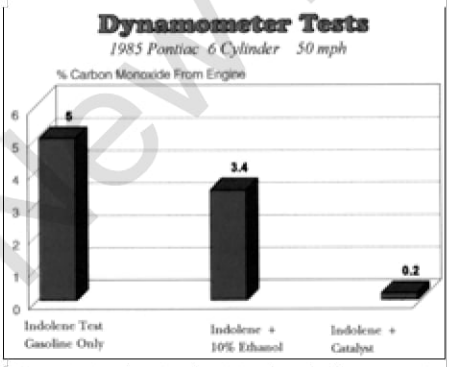


Figure 9. During steady state chassis dynamometer testing, the fuel catalyst produces a 96% reduction in carbon monoxide emissions at 50 mph.

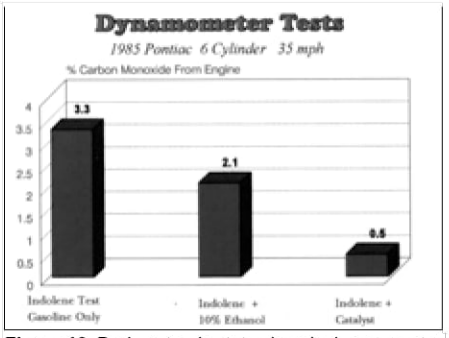


Figure 10. During steady state chassis dynamometer testing the catalyst produces an 85% reduction in carbon monoxide emissions at 35 mph.

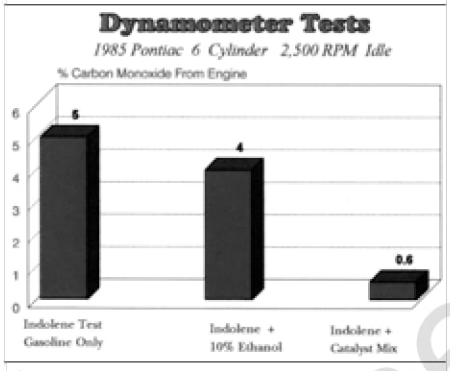


Figure 11. Steady state testing shows an 88% reduction in carbon monoxide emissions from the engine exhaust at a 2,500 rpm idle.

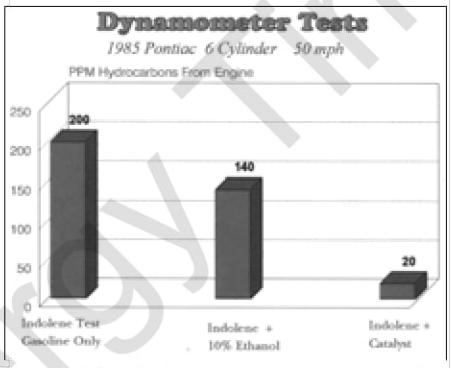


Figure 12. Steady state chassis dynamometer testing produces a 90% reduction in hydrocarbon emissions from the engine exhaust at 50 mph.

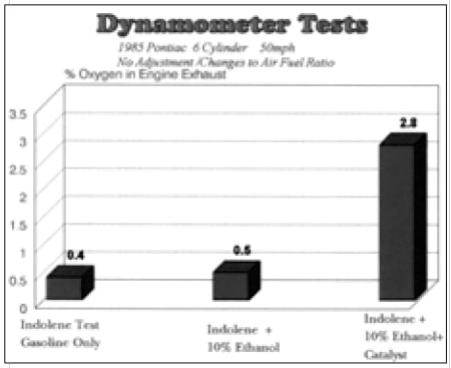


Figure 13. During the steady state chassis dynamometer testing series the catalyst produced a 700% increase in measured oxygen from the engine exhaust. No adjustments were made during the test.

Figure 17. (Right) Using the combustion catalyst, hydrocarbon emissions dropped by 72% on a Pennsylvania state emissions test since the last recorded test and 30% better than the best recorded level for this vehicle.

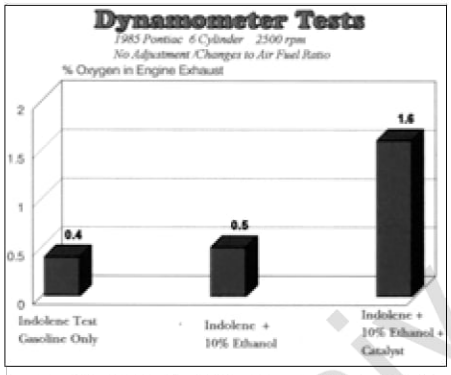


Figure 14. During the 2500 rpm engine idle test the catalyst produced a 400% increase in measured oxygen at the engine exhaust. No adjustments were made during this test series.

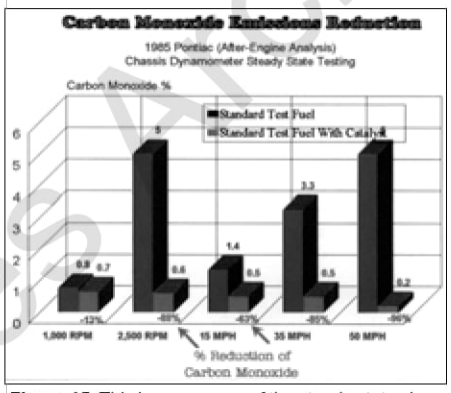


Figure 15. This is a summary of the steady state chassis dynamometer testing program. It was done at a recognized laboratory using instrumentation supplied and calibrated by a major manufacturer of industrial emissions instrumentation.

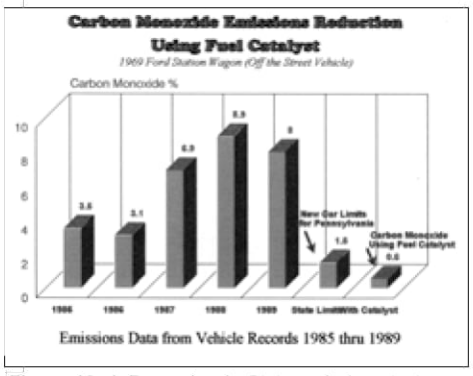
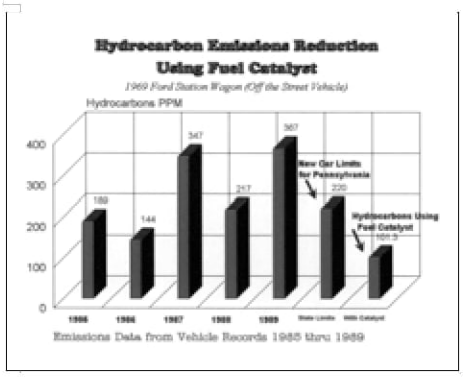


Figure 16. A Pennsylvania State emissions test was run on an older vehicle without modern emission controls to determine the catalyst effect. Carbon monoxide dropped by 92% since the last recorded state emissions test. It dropped 80% compared to the lowest recorded data for the vehicle.



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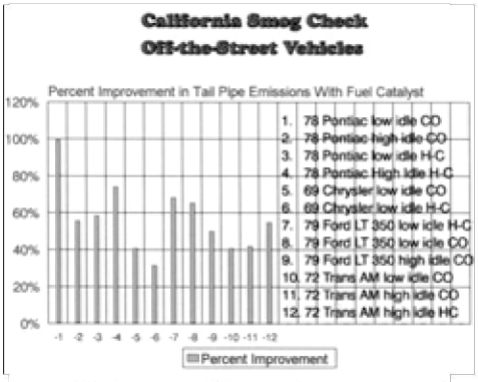


Figure 18. A number of older vehicles were treated with the catalyst and tested at official California Smog Stations. This is a record of the changes produced. Many additional vehicles were tested with similar results. The large reductions in pollution are typical of many other test results.

Heavy Duty Diesel Testing Program

The heavy duty Diesel testing program has produced important and valuable results. Some of the test results of heavy duty diesel equipment using the fuel catalyst are listed:

- A Canadian long-haul trucking company claims a 25% fuel savings between Canadian cities using the fuel catalyst.
- A long distance New Jersey refuse hauling company produced a 14% fuel savings during a test series.
- A long-haul Canadian passenger bus and freight company calculated a 10% fuel savings during a 11,500 mile demonstration test.
- A 4,000 mile test series between metropolitan New York and Arizona produced a 12% fuel savings.
- Chassis Dynamometer testing produced a 30% NO_x reduction at a California Laboratory
- Engine Dynamometer testing using a Big Cam 4 Cummins engine recorded a 50% NO_x reduction and a 12% fuel consumption [BSFC] improvement
- Engine Dynamometer testing using a Detroit Diesel engine recorded a 9% NO_x reduction and a 6.8% fuel consumption [BSFC] improvement

Letters and Summaries Follow:

Diesel Engine Test

Date: January 10, 1995
Engine: 8V71T Detroit Diesel [N75 Injectors]
Test Protocol: SAE J1003 6/90
[SAE Recommended Practice]
Test Site: California Environmental Engineering
Heavy Duty Emissions laboratory

Data subject to review

Test Results	Baseline	With Fuel Catalyst	Results
BSFC	0.544	0.507	6.8%Improvement

BFSC = Brake Specific Fuel Consumption

Diesel Engine Test

Date: August 8, 1995
Engine: Cummins Big Cam 4
Test Protocol: SAE J1003 6/90
[SAE Recommended Practice]
Test Site: California Environmental Engineering
Heavy Duty Emissions laboratory

This is Reported Data from a Recognized Heavy Duty Engine Emissions Laboratory

Data subject to review

Test Results	Baseline	With Fuel Catalyst	Results
BSFC	0.405	0.355	12% Improvement

BFSC = Brake Specific Fuel Consumption

DynoData Inc. - a wholly owned subsidiary of
ADVANCED COMBUSTION TECHNOLOGIES INC.
2769 TeePee Drive, Stockton, California 95205
(209) 469-3966 FAX (209) 469-3970

September 14, 1995

Harry Taplin
Crystal Energy Inc.

RE: Crystal Energy Additive test results.
Dynamometer tests conducted July 06 thru Aug 08, 1995.

In a preliminary report dated August 24, 1995 we showed 20% decrease in NO_x emissions from the diesel engine as result of the use of your additive.

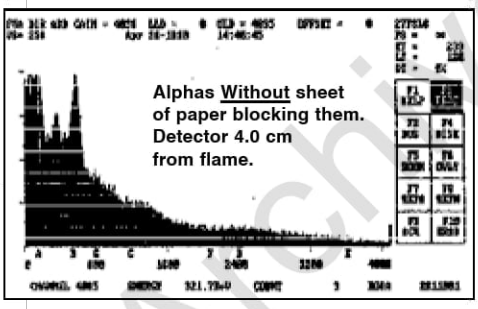
Untreated fuel was reported as 11 g/hp-hr NO_x average. Treated fuel (Crystal Energy Additive) was reported as 9 g/hp-hr NO_x average.

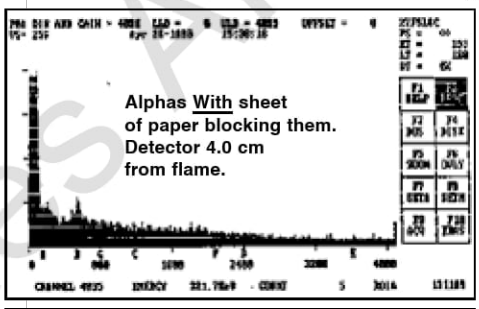
Tests were conducted in the A-B-A format and final tests results showed are;
baseline of 11.75 grams per horsepower/hour NO_x.
lowest level 8.25 grams per horsepower/hour NO_x.

These results indicate a 30% reduction in NO_x emissions when diesel is treated with the Crystal Energy Additive.
A full report is enclosed.

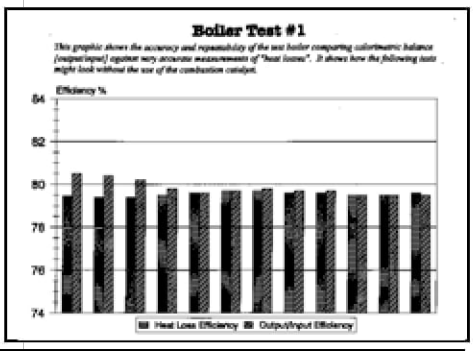
Sincerely,
Gene Glanzer, DynoData Inc.

Additional Support for the Validity of the Alpha Particle Measurements in Augmented Combustion

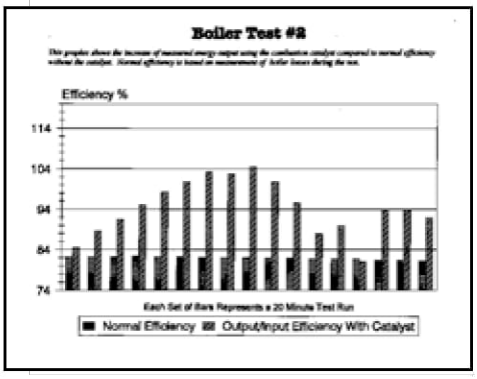




Comparison of Heat-Loss v.s. Output/Input Measurements of Boiler Efficiency...



Thus, the 100%+ efficiency numbers with catalyst are all the more remarkable...



"The energy produced by the atom is a very poor kind of thing. Anyone who expects a source of power from the transformation of these atoms is talking moonshine." — *Ernest Rutherford, 1933*

New Energy Times Archive

THE LITHIUM - FAST PROTON NUCLEAR REACTION "LIGHT ELEMENT FISSION" DESCRIPTION AND COMMENTS

William D. Gwinn
Emeritus Professor - Chemistry
University of California - Berkeley

Prepared for Crystal Energy, Inc.

October 26, 1989
The Lithium - Fast Proton Nuclear Reaction or "Light Element Fission"

Abstract

This paper briefly describes a nuclear reaction which I have recently observed and sets forth my view of its potential for safe energy generation.

The basic reaction is Li + H* → 2He. (Alphas). This nuclear reaction between lithium and fast protons was first discovered in 1932 by Cockroft and Walton and is one of the earliest observed and studied. They observed single collisions of elements using tracks in a cloud chamber.

The experiment which I have observed employs a high voltage electric probe in a lithium bearing flame to accelerate some of the particles in this vapor or gas phase. In this medium there is a chain reaction. The core departure from the earlier research is to allow the lithium-proton reaction to propagate in a three dimensional framework rather than be constrained to a two dimensional film, as the experiment, heretofore, was always conducted.

Early runs of purposely limited size have given alpha counts of 1,000,000 per minute. We are moving slowly to scale up the experiments to obtain improvements of 1,000 times current levels.

The promise of this new technology—the propagation of a nuclear reaction through proton excitation in a vapor phase—is one of almost limitless energy with no nuclear waste products, no long range effects, no gamma ray or neutron creation and a reaction in which everything happens, instantaneously with no residual radioactivity.

Experimental Program

The nuclear reaction between fast protons and lithium— Li + H * → 2 He — is one of the earliest observed and studied. It was discovered in 1932 by Cockroft and Walton. They developed one of the earliest particle accelerators. With a beam of 120 kilovolts of energy, they observed the reaction of lithium and fast protons to product two alpha particles. They observed single collisions using tracks in a cloud chamber.

Several years ago, Crystal Energy, Inc. chose this reaction to study in an attempt to develop an alternate source of nuclear power. This approach has many advantages over the current methods of nuclear power, especially in the areas of safety and economical equipment and fuel costs.

It should be emphasized that the lithium-fast hydrogen experiments have no relation to the current "cold-fusion" reactions. The lithium experiments are not cold, nor are they fusion. They are simply another nuclear reaction. They might be called "Light Element Fission." This term is not in common usage at this time, but it is a most appropriate and descriptive term for this reaction. In this reaction a light particle (proton) enters a heavier nucleus (Li) and forms a transient nucleus (Be^8). The compound, nucleus then splits into two parts (2 alphas) in about 10^{-16} seconds.

The lithium-proton action produces these two alpha particles, each with 8.6 Mev of energy. This is equivalent to 9,914,000,000 BTU per pound of lithium nitrate. We would never expect 100% conversion, but there is a vast amount of energy available from this reaction. The unused lithium is easily recovered, but considering the low cost and availability of lithium, it will probably be better to optimize the system on other factors.

A number of test runs have been made on small flames which are 1- 2 cm. in diameter. An alpha counter was placed at the side of the flame, within a few centimeters. The counter registered only a few counts (no lithium). With only the addition of lithium, the counting rate rose above 1,000,000 count/min. The counting dropped off sharply at 5-6 cm., as would be expected for alpha particles. A smaller number of counts, 200/min., persisted out to 1.5 meters, as would be expected for protons. Very weak x-ray or gamma radiation (up to 5 Kv.) were also detected. These very soft x-ray were easily stopped with thin metal shields.

Experimental Conclusions

I have conducted a large number of calculations on the probability of penetration of the lithium-proton barrier. On the basis of the numerical values we decided that we could try for 20 - 30 Kev. Some early experiments (in the 1930's) had also shown that the reaction could be detected down to 12 Kev, but with very low yields. This is in agreement with our calculations. We chose trying for the higher voltage and much higher yields. It was found that one of the high performance automatic ignition coils would produce pulses of 100 KV with a width of 500 microsecs.

At this time, we should point out that our methods are quite different from the other "hot" fusion experiments being conducted today. In the competing fusion reactions, the emphasis is to produce a very high temperature and to find some way to contain the high temperature substance for a time period that is long enough for a reaction to take place (*i.e.,* the Tokamaks, Laser and Magnetic Bottle, Inertial Confinement methods, etc.) Our philosophy is to accelerate some of the particles in the gas phase to a very high degree and leave the other particles relatively cool. Our 20 Kev. protons correspond to the average energy of a gas at 2,320 million degrees centigrade. It should also be noted that the flame does nothing but provide a medium to get lithium into the gas phase. The flame temperature is well below 11,600 degrees centigrade, which corresponds to 1 electron volt. This is below the required 20 - 30 Kev. Our aim it to keep the reaction mixture cold (3,000 °C) and have a few very high energy particles which react with the lithium.

It turns out that the experiment as presently structured, results in a chain reaction. When a fast particle goes through another material it causes ionization but it also makes some other elastic collisions with the nuclei tearing them loose from the molecule, and accelerating them to high velocities; Rutherford spoke of "swift hydrogens" in the early 1930's when observing alpha particles. The 8.6 Mev alpha particles also produce fast protons in the gas phase. Extensive trajectory calculations were made and they show that the cross section for this reaction is quite large, especially after the particles have slowed down. This phenomena gives us a mechanism for a chain reaction whereby the initial protons are accelerated by the spark pulse. The protons then react with the lithium to give two alpha particles. The 8.6 Mev. alpha particles, travel through the gas which contains hydrogen atom bound to carbon in the form of hydrocarbon fuel, or to the hydrogen bound to oxygen in water, or anything else that has hydrogen in it. The hydrogen nuclei are freed from the molecule and accelerated up to 5.4 Mev for a direct hit. These fast hydrogens also produce more fast hydrogens in elastic collisions, but more importantly, they also hit lithium nuclei and produce more alpha particles. Thus, there are many more fast protons to react with the lithium to pro-

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duce more alphas and so on.

The most important question here is, does it work? The answer is yes. Early trial runs have alpha counts of 1,000,000 per minute. These have been obtained in small experiments and we are confident of being able to quickly obtain 1,000 times improvement. For safety considerations, we want to move slowly at this point. We want to make some measurements and computations on dynamics of the reaction before proceeding on to higher levels. It should be noted that the alphas we count are those that are escaping from the flame before being used to regenerate the reaction. They represent a lower count to the extent of the reaction we are seeing. As the counter is moved from the flame, the count level drops abruptly at the end of the alpha range (in 5 - 6 cm.), as expected for the 8 cm alphas. At greater distances the count continues at a much lower rate as a result of measuring the fast protons. These all die out slowly and by 1.5 meters they are no longer detected. Some very weak, soft gammas (500 Kv) are found at longer distances. These are monitored and can be easily shielded, (1/8" steel).

Safety and Operating Benefits

In considering the safety of this reaction, it should be noted that the reactants and the final product are neither poisonous nor radioactive. The alpha particles, for example, give up all of their energy to become ordinary helium atoms; suitable for filling balloons for children's parties. Some fast protons will be formed by the alpha particles. They, like the alphas, will travel in air until they have lost most of their energy. This is a bit longer than for alphas but in about 24 feet they will be slow enough to pickup an electron, and with oxygen of the air, form water, or be consumed in some other benign reaction. The main reaction produces no residual radioactivity. Even without shielding, it will be difficult to detect any radiation (except for a very small amount of soft x-rays from some of the auxiliary equipment). This is experimentally true at the present time with low level experiments.

The most important contrast is that in the lithium-proton reaction everything happens instantly and there is no residual radioactivity. In a fission reactor a failure might release fission products that are intensely radioactive and will last for thousands of years to come. In contrast there is nothing to clean up if there should be a failure in the lithium reactor.

A second safety consideration, is that the main reaction produces no long range effects. No gamma rays and no neutrons are produced. These are emitted in copious amounts by the material in the core of the standard nuclear power reaction. These are effectively screened in a fission reactor, but the screens are extremely bulky and expensive.

It should also be noted that a lithium power generator could go through a major earthquake with only physical damage to the reactor comparable to the physical damage to the surrounding buildings. There would be no radioactive material to spread around.

While the main reaction is a very clean one, there are, some possible side reactions which are accompanied by some gamma rays and neutrons. These are expected to be of much lower probability than the main reaction. Experimentally, they have not been observed, even in the presence of 1,000,000 alpha counts/minute from the main reaction. Some soft x-rays have been observed, but they are effectively shielded by a 1/8" steel plate.

This count rate (1 million/min.) is very high compared to the count rate observed, for example by Friedlander et al at Brookhaven National Laboratories as reported in *Phys. Rev. Letters* (63,1292 [1989], Sept. 18, 1989) and in most newspapers. Their count rate was 1 event per 6 seconds. (10/min.) Even though our results represent only a small fraction of a BTU/hour, it is to my knowledge, far ahead of any of the many competing fusion projects, and ours is also cheaper by about the same ratio. As stated above, our values are only lower bounds to the actual amount of reaction we are getting.

Biographical Information on Emeritus Professor of Chemistry William D. Gwinn

from UC Berkeley Communications Office, from a 1977 document.

William D. Gwinn received his AB in chemistry, mathematics, and physics at the University of Missouri in 1937, his M.A. (University of Missouri) in 1939, and his Ph.D. from Berkeley in 1942. He is a member of the American Chemical Society and a Fellow of the American Physical Society. He has held a Guggenheim Fellowship, a Sloan Fellowship, and a Research Professorship in the Miller Institute. He joined the Berkeley faculty in 1942.

Professor Gwinn's research interests have covered a number of topics, mainly in the fields of chemical physics and theory. These have included statistical thermodynamics, photochemistry, micrometeorology, infrared and Raman spectroscopy, quantum mechanics, microwave spectroscopy, energy transfer, astrochemical physics, and the development of methods of solving chemical problems using computers

Editorial continued on from p.5

Journal, who was hounded into silence on cold fusion (and his articles were severely truncated when they appeared at all) even before he retired.

So, how can we gain respect and recognition for this field to which you have devoted so much of your time and energy? Are you going to wait around for a "miracle" to happen? Are you going to go to your grave without wider recognition? For some of you, sad to say, perhaps you will.

But there *is* a solution—a powerful "nuclear weapon" that is waiting to be unsheathed and unleashed against the farcical science/media establishment. This weapon can wreck total havoc against that unholy alliance. It is simply this: Manufacture and sell demonstration heat-producing devices. Make them so widely available — *give* them away initially, if you have to— so that the noise they will make will quickly grow deafening.

Just try to imagine where this field would be today if a reliable excess heat device illustrating the "cold fusion effect" had been sold through the very popular Edmund Scientific Company's *Scientifics* Catalog on a "see it for yourself" basis. Can you imagine the effect of unleashing this to all the high-schools and colleges on the planet? After that it would make no difference what nonsense Caltech or MIT professors spouted. The *students* would get rid of them by proving them wrong. Ah, but you say , "I am fearful of losing control of my proprietary technology." We have just one word for this attitude, NONSENSE!

We know, this latter message is getting to sound like a broken record. The only problem is this: *most of you aren't getting it!* Are you deaf or blind or are you masochists? How much more of this beating up by the Establishment do you want to take?

All right, not all of you have experiments and technologies that are at the stage where demonstration devices can be sold, but many of you *are* at that point. *We know this.* In many cases we have seen or inferred what you have behind closed doors. For those of you who are not even close to such demonstrations — OK, pursue your quiet science, but don't expect research funding or respect until some one or more group is out there vending energy-producing devices to the world.

When demonstration devices and then scaled-up commercial products that heat water and generate electricity are avail-

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Arata and Zhang's Cold Fusion:
Excess Heat and Helium Production
A Review by Mike Carrell

Introduction

Outstanding among the many confirmations of the pioneering findings of Fleischmann and Pons (F&P) is the work of Prof. Yoshiaki Arata and Prof. Yue-Chang Zhang, (A&Z) both of Osaka University in Japan. A special 56-page issue of the *Journal of the High Temperature Society* (HTS) of Japan[1] was devoted exclusively to a paper summarizing their work. **This work unambiguously links the production of substantial, robustly generated excess heat with the production of helium in a system involving electrolytic loading of deuterium into palladium metal.**

My purpose in this essay is to present this work to the readers of *IE* in a readable form, answering a number of concerns that have been raised in critiques in certain Internet groups. The 1997 A&Z HTS paper is a summary, omitting details covered in their earlier papers. In this essay I blend information from several papers into a coherent narrative. In a few cases, I offer hypotheses to explain certain features of the data not explained by A&Z, which I have clearly indicated. Some of the figures in the text have been traced from scanned images available from several papers. The tracing clarifies the images and in some cases I have added explanatory annotations. In all cases, the figures are a faithful representation of the data in the A&Z papers.

About Professor Arata

Osaka University in Japan has named a building after him—such is his fame as a top-ranking scientist. His address is Arata Hall and a booklet issued by Osaka University listing his accomplishments requires 40 pages. He was awarded the Emperor's Medal, the only physicist so honored in Japan. Arata was involved in Japan's experimentation with high-energy plasma fusion (hot fusion) as early as 1958. The collaboration with Ms. Zhang (Professor in the Welding Institute) began then, with early investigation of fusion in solid bodies. With the F&P announcement in early 1989, the focus of their work shifted to electrolytic cells, and they were able to announce positive results in 1990. In Japan, it is acceptable and not unusual to work on both hot and cold fusion processes.

Why Aren't You Dead?

When Fleischmann and Pons announced that they had produced abnormal "excess" heat from an electrolytic cell using heavy water and a palladium cathode, and that they thought that a nuclear fusion reaction might be involved, the critic's question became "Why aren't you dead?" *If* the *known* hot fusion reactions were producing the "excess" heat claimed, these reactions, it was *said*, would also produce high and perhaps lethal doses of penetrating radiation. (Whether it would actually have been *lethal* is a matter for exact calculation of dosage, but certainly the radiation would have been significant and easily detectable.) Clearly Fleischmann and Pons and their graduate students were very much alive and well. What, then, was the source of the heat? Therein lay the essence of the emerging cold fusion controversy.

The Rutherford Fusion Reaction

The US and other governments have invested billions of dollars over many decades in projects to produce controlled fusion of hydrogen isotopes, which yields high energy output per fusion reaction but which also requires high energy input. Hot fusion requires forcing isotopes of hydrogen together, which is resisted by the mutual repulsion of the positively charged nuclei, until a critical distance between them is reached. Then the *strong nuclear force* takes over and the nuclei fuse, only to break apart in secondary reactions— releasing energy from mass conversion after the equation $E = mc^2$, where m is the mass lost in the reaction. The fusion conditions are very difficult to produce, requiring a star, a thermonuclear explosion ("H-bomb"), or very expensive magnetic or laser machines, that is, until the F&P experiment done in an electrochemical cell. There are several well studied fusion reactions. One of these, the Rutherford reaction, is the one F&P anticipated. In Table 1, it is compared with the initial results of F&P and those of A&Z.

Table 1 indicates the foundation of the "Cold Fusion" controversy. Governments had invested billions in a reaction involving tritium and deuterium, because the deuterium-deuterium reaction is much harder to do. In Tokamaks, brief bursts of power nearly approaching the operating power have been seen, but over the long term the energy yield is less than the energy required to run the system. While the fusion reactions in Tokamaks do not themselves produce radioactive waste, the high energy neutron radiation which penetrates the reactor walls to produce useful power also makes them radioactive. (Moreover, the neutrons generate the needed tritium fuel for the reactor (bootstrap fashion) by neutron bombardment of molten lithium metal surrounding the chamber.)

Table 1

Reaction Product	Rutherford	Fleischmann & Pons, 1989	Arata & Zhang, 1989-97
Helium 3 (^3He)	50 %	Note 1	Yes
Tritium (T or ^3H)	50%	Note 1	No
Helium 4 (^4He)	1 : 10 million	Note 1	Yes $^4He/^3He = 4$
Gamma Radiation	23.8 MeV energy	Note 1	Note 2
Neutron Radiation	2.45 MeV energy	Low level claimed, retracted.	Note 2
Energy Out/In>1	Theoretically yes, not achieved in practice.	Initially small, elusive Later 100s of Megajoules	Robust, 200+ Megajoules per cc of active material

Note 1: F&P did not test for ^3He or ^4He; they did test for tritium (T) and found it. (Many other investigators of the F&P cell found higher levels of T later). Helium has been found by several other investigators, including A&Z, but not in the proportions expected from the Rutherford and other known nuclear reactions. F&P did not detect gamma radiation.
Note 2. A&Z did not report gamma and neutron radiation, nor the search for them, in the papers I have seen.

Now F&P claimed safe over-unity heat production from a fusion reaction that did not have the usual radiation signatures. Attempts to duplicate F&P results usually produced feeble, if any results. There were also several positive results that were deemed "negative" by critics bent on disproving F&P. Critics claimed that the measured heat was from obscure chemical reactions, or energy storage, or the result of faulty measurements. F&P did not emphasize how difficult it is to produce the effect. In retrospect from

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1998, it is possible to see what the problem was, now that many successes have been confirmed. **Among these is the work of A&Z, who have demonstrated in a vivid way the essential correctness of F&P's vision. They show strong evidence of a nuclear fusion reaction that does not fit the conventional rules.**

The Cathode Problem

Metallic palladium is a three dimensional lattice of palladium atoms spaced evenly in a face-centered cubic array (atoms at each corner of a cube and the center of each face). Within this lattice there is space for hydrogen or deuterium nuclei (deuterons, D^+). There are several ways to load deuterons into palladium, such as: a) gas pressure, b) ultrasonic cavitation in heavy water, and c) electrolysis —the method chosen by F&P.

Deuterium is readily absorbed in two phases. From the gas phase D_2 gas is dissociated by catalytic action at the surface and deuterons enter the palladium lattice. In a F&P cell, D_2O is dissociated by electrolysis at the cathode; part of the deuterons combine to form D_2 gas which escapes as bubbles, another part diffuses into the cathode metal lattice.

Initially, in the alpha phase, the deuteron concentration is low. The deuterons are essentially in solution, and free to diffuse or migrate. As more deuterons are pumped into the lattice, they interact with each other and the lattice and find positions of equilibrium among the palladium atoms. This is the beta phase. At this point the cathode swells and cracks may appear from internal stresses, allowing the deuterons to leak out and form D_2 gas.

In the solid cathodes used in traditional F&P cells, the electrolyte surrounds the cathode and deuterons diffuse in from all directions. Voids in the cathode metal are sinks where deuterons can accumulate as D_2 gas under pressure, delaying the transition to the beta phase. *A&Z turned this to an advantage*, which we will see below.

F&P reasoned that electrolysis could be used to generate the equivalent of high gas pressure to force still more deuterium into the palladium lattice, and that under such pressure and proximity of deuterium atoms, fusion reactions might occur. From a 1998 perspective, many experiments indicate that the loading must be such that 85% or more of the possible deuteron sites are occupied for the reactions to begin.

Loading and maintaining palladium at this level is quite difficult. Not all samples of palladium will load well, and even those which load may not show the F&P effect. Best results are reported for palladium from a single supplier, ordered from a single production lot of metal (perhaps containing special beneficial impurities). Yet researchers report that those cathodes which do work will work in many cells.

F&P did not emphasize these difficulties. Many researchers thought the experiment looked easy, reached for a handy lump of palladium and some heavy water, and tried the experiment. A few succeeded. Many ran the loading phase of the experiment for weeks or months without seeing any result, or feeble, transitory effects. Critics claimed that obscure chemical reactions were responsible for any heat seen, or that the energy put in the cell during the long loading phase was merely being returned in a short burst, like a charged battery.

To this day, there is no accepted theoretical guide to the conditions which produce the F&P effect. There are recipes which work for various experimenters, and it is clear that electrolysis is only one way of producing the necessary loading, or concentration of deuterons within the Pd lattice.

As early as 1958, A&Z had been investigating ways of producing fusion in solids, and had worked with shells and cylinders of palladium and with colloidal (finely divided) palladium, or palladium black (Pd-black). With the F&P announcement in 1989, they decided that the reaction occurs near the surface, not deep within the bulk of the cathode. This led to their development of a "double-structure" (DS) cathode, which proved very successful.

The Arata & Zhang Double Structure (DS) Cathode

The DS cathode is machined from a solid rod of palladium, forming a capsule with a cavity in one end which is sealed with a welded plug. The cavity is packed with Pd-black under vacuum conditions, so that it is substantially filled with the Pd-black in contact with all the walls and filling the cavity.

In some experiments, a pressure gauge was attached to the capsule to measure internal gas pressures. Thermocouples were also used to measure internal and surface temperatures in other experiments. In the critical energy runs discussed below, the capsule was sealed without attachments or probes except the electrical connection for its function as the cathode in an electrolytic cell.

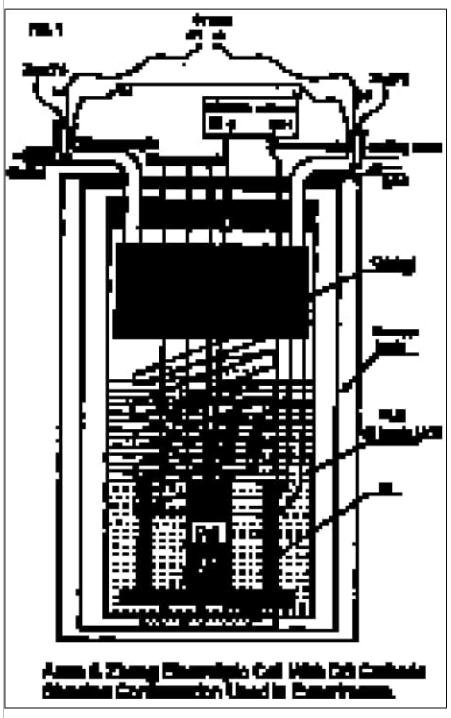
A&Z avoided many of the problems of solid cathodes by using Pd-black. With particles as small as 40 nanometers across (about a hundred atoms), it was practically all surface and could hardly be broken into smaller particles by the stresses of loading deuterium gas. I discuss the processes within the DS cathode a bit further on.

Robust Performance of the DS Cathode

A&Z were working with the DS cathode structure at the time of the F&P announcement. From 1990-92 they ran many trial-and-error experiments. In 1993 they gave a preliminary report to ICCF-4. From February 1993 to May 1994 they continually experimented with excess heat and reproducibility, which included cycling the cell on and off every few days. The cell was idled for a year, then restarted for a 3000-hour run (at the time of a report dated 23 Dec. 1994). This 1994 report shows excess heat vs. time curves before and after the year-long shut-off; the performance is substantially the same.

The A&Z Test Cell

Fig 1 shows a schematic diagram, reproduced from an A&Z illustrations. It shows the principal features of their cell in their functional relationship as used in



experiments.

Closed Cell. The cell itself is closed. The electrolysis releases oxygen and deuterium gases, which carry heat energy out of

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the pool of electrolyte and would result in a potentially explosive buildup of gas pressure if it were not for the recombiner catalyst.

Recombiner. Above the pool of electrolyte is a porous body containing a catalyst, usually platinum, which induces the oxygen and deuterium gases to recombine, forming heavy water (deuterium oxide), which drips back into the electrolyte solution. This returning fluid also returns the heat energy removed as gases.

Insulating Jacket: The cell is contained within an insulating jacket which is often a vacuum bottle, or Dewar flask, but can be of any highly insulating construction. Heat can escape from the cell by many subtle paths, even "leaking" along electrical conductors and supports. Calibration is necessary, which A&Z did.

Cooling Coil. The cell is cooled by water flowing through a helical glass coil, substantially submerged in the electrolyte pool. The inlet and outlet temperatures of the water are measured by thermocouples attached to recording equipment. The flow rate is measured by an instrument not shown, also connected to recording equipment. Knowing the flow rate and the temperature differential between inlet and outlet, the heat produced within the cell is easily calculated.

Anode. The anode is a cylinder of platinum, about the length of the cathode and the diameter of the cooling coil, located just below the cooling coil, and connected to an external power supply by an attached wire which exits through the cell closure.

Cathode. The cathode is a capsule placed at the bottom center of the cell, connected to the external power supply by a wire which exits through the cell closure.

Calorimetry Considerations

It happens that calorimetry, the measurement of heat, is something that looks simple but is a maze of subtle traps for the unwary. It is closely related to thermometry, the measurement of temperature, which is only slightly less hazardous for the unwary. Yet it is the production of "excess" heat which is the key signature of the new energy reactions. It takes a certain amount of energy to operate an electrolytic cell, which will produce heat, release gases, and produce other chemical reactions. In the F&P effect, after all ordinary sources of heat and chemical energy are accounted for, an "excess" heat release is found. At first, the "excess" was small and critics cited various kinds of measurement errors as the source of apparent "excess." Later experiments showed robust, powerful heat release, in the range of hundreds of watts, on a continuing basis. A full discussion of calorimetry is beyond the scope of this article.

Calorimetry of the A&Z Cell

Two basic approaches to calorimetry are *static* and *flow calorimetry*. In static calorimetry, the cell is isolated within an insulating jacket, all fluids are retained, and the temperature is maintained constant. Usually, the cell is maintained at a constant elevated temperature by a calibrated electric heater. Heat produced by a reaction inside the cell reduces the power necessary to the heater to maintain the constant temperature. This method requires careful calibration.

Flow calorimetry, chosen by A&Z, removes heat by means of water flowing through a cooling coil, as seen in Fig 1. It is only necessary to measure the inlet and outlet water temperatures, and know the flow rate, to calculate the heat produced. The method is self-calibrating.

Some cell configurations used by other researchers have been criticized for measuring temperatures at single points, which may not be representative of the average temperature, and for inadequate mixing of liquid. A&Z avoid these problems by the features shown. The central, lower location of the cathode capsule encourages a general circulation of the fluid, rising in a warmed plume from the central cathode, and sinking around the outer periphery, enclosing the cooling coils. Gas bubbling from the anode and cathode further mix the fluid.

Inlet and outlet temperatures are measured at single points, but these are within the bore of a tube carrying water which circulates in a spiral through the electrolyte pool, mixing and exposing all sides to the surrounding fluid before exiting. Thus while a single point temperature measurement of exit temperature is made, it is representative of the average temperature of the whole body of electrolyte.

Calibration of the A&Z Cell

Calibration is accomplished by substituting a platinum cathode of the same size and shape as the palladium cathode and running the electrolysis reaction at representative power levels. Platinum does not produce the F&P "excess heat, " but all other features of the cell and its support system are the same. Fig 2 shows the results of such a calibration, reproduced from A & Z with labels modified for clarity. Fig 2 shows heat produced within a cell using a platinum cathode of the same size and shape as the palladium DS cathode. By applying least squares

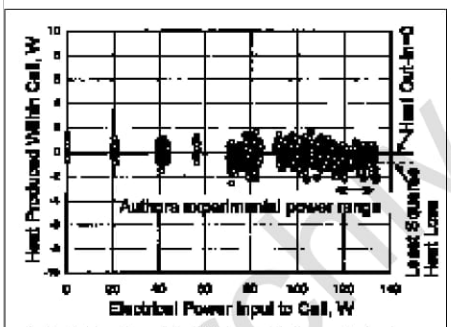

Fig 2. Calibration of Cell Using a Platinum Cathode

statistical analysis to the data points, A&Z show that the cell loses about 0.7 watt of power when operated at its normal range of 120-135 watts input. There is a scattering of data points within a range of +/- 2 watts peak-to-peak, but mostly clustered between +/- 1 watt. These numbers are important in evaluating data presented later.

It will be shown that this variability does not obscure the measurement of very large energy release from the A&Z cell, but some critics have seen this variability as an indication of experimental weakness.

The Energy Measurement

Fig 3 gives a plot of excess power from an A&Z cell with a palladium DS cathode capsule filled with 3 grams of Pd-black. In this graph, the horizontal 'zero' line represents the heat equivalent of the electrical input power to the cell. All points above this line represent measured "excess" power produced by the processes in the DS cathode. The run extends for about 4800 hours. A&Z state the released energy (integrated power over time) to be in the range of 200-500 megajoules/cm^3 of active material (the Pd-black). This is far, far beyond any possible chemical reaction. It is far beyond any government hot fusion program, where the energy released has never exceeded the energy necessary to run the experiment. Only nuclear reactions are known to produce this kind of energy density, but the expected radiation signatures of the Rutherford reaction are missing and Arata and Zhang remain in good health. The data looks noisy and variable, which has led some critics to assume that the measurements are not those of a real operating process but consist entirely of artifacts of a poorly constructed experi-

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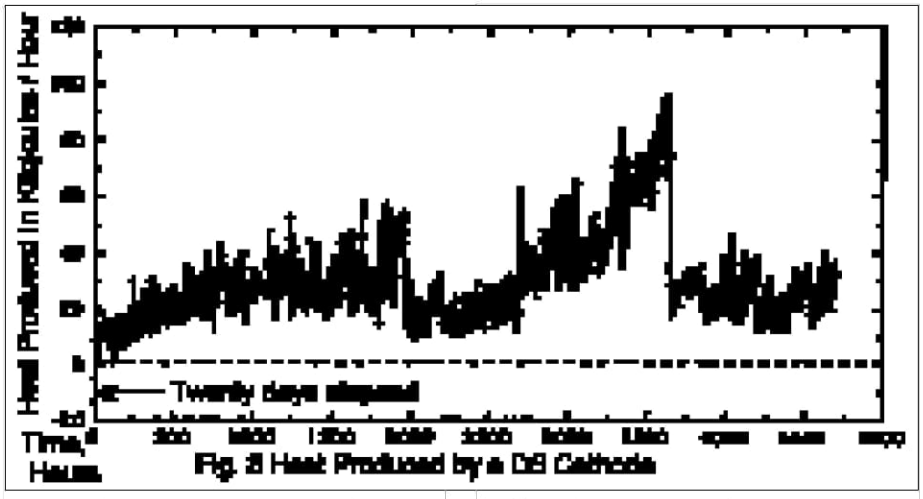

Fig. 3 Heat Produced by a DS Cathode

ment. What is truly important about Fig 3 is that the plotted energy is in all cases clearly above the reference line. Whether variable or not, all points represent energy released from the DS cathode. Summed over the 4800 hour duration of the experiment, hundreds of megajoules per cubic centimeter of active material were generated. This is to be compared with the slight (0.7 watt) average heat loss from the cell during the calibration runs. Because of the importance of the energy measurement, this will be discussed in some detail in a later section.

The Mass Spectrometry Measurement

The energy release indicates a nuclear reaction, but a nuclear reaction should leave tracks, a signature. The expected signature of the Rutherford D-D fusion reaction was given in Table 1. The penetrating radiation is not seen, but what about the "ash," helium isotopes ^{3}He and ^{4}He and ^{3}H (tritium)? Other investigators have claimed to see these products, but the method of analysis is always challenged by critics. Traces of helium are in the environment and are very difficult to exclude.

The standard method of detecting is by a quadrupole mass spectrometer (QMS). Mass spectrometry in general proceeds by vaporizing a sample, ionizing it by an electric field, and then moving the ionized particles by a combination of magnetic and electrostatic fields such that they take curved paths whose radius depends on the mass, and counting the number of particles that fall on a detector for each setting of the controlling fields. Knowing the conditions, the quantity of particles of each mass can be measured. A quadrupole mass spectrometer is simply one in which four magnetic poles are used in a very compact design. A&Z were familiar with well-known drawbacks of conventional QMS, so they designed a special system which avoids them. It is shown schematically in Fig 4.

General Construction: Stainless steel, with metallic gaskets and gate valves, standard practice in high vacuum work. The valves can seal off each component

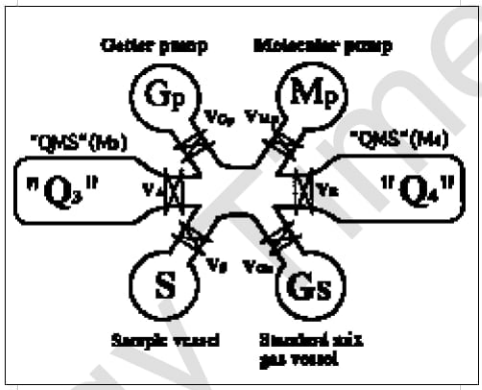

Fig. 4 Schematic Configuration of "Closed QMS" System

of the system as needed. QMS(M3) and QMS (M4): Two quadrupole mass spectrometers are provided, one primarily tuned to look for Mass 3, which includes compounds of D and H (including ^{3}H, or tritium), and ^{3}He. The other is tuned to Mass 4 (which includes deuterium gas D_2) and the normal isotope ^{4}He. Both QMS can scan for other masses as well.

Standard Mix Gas Vessel: This contains a standard gas used to calibrate the mass spectrometers.

Molecular Pump: This is essentially a very high speed turbofan made of stainless steel which sweeps any molecules entering it back towards a positive displacement pump which removes the concentrated gas from the system.

Getter Pump: A getter is like "molecular flypaper"; surfaces coated with a small family of very reactive metals will capture gas molecules of all types except helium, which is chemically inert. (A generous getter coating on the inside of television picture tubes maintains the necessary high vacuum over many years, even though organic binders are used with the phosphors on the faceplate which produce the light). Getters will produce harder vacuums than molecular pumps. Usually the getter is initially in the form of oxides in a small cup. When most gas has been removed by other pumps, the oxides are heated, evaporating them, coating the active metal on a passive surface while the oxygen is pumped out.

Sample Chamber: Pd-black removed from an energy run such as shown in Fig 3 is placed in this chamber, where it can be heated to 1300 C.

QMS Operation

The basic operational sequence is as follows (variations were used in special cases):

1) Place the sample in the sample chamber and seal the valve to the outside world.

2) Open all internal valves and start the turbomolecular pump and its backup pump.

3) Pump for 5~15 hours to a pressure less than 10^{-8} Torr.

4) Activate the getter pump.

5) Close the pump valve and stop pump.

6) Heat the sample in step-wise increments to 1300° C

7) Scan QMS repetitively over the mass ranges of interest, Mass 3 and Mass 4

What happens in this sequence is that the Pd-black particles are initially coated with various pollutants from exposure to the laboratory environment before and after the heat generation in the DS cathode noted above. These pollutants are driven off by the progressive heating. Since they are chemically active, they will be captured by the getter pump. Then, as the heat increases, deuterium and helium isotopes (created by the nuclear reactions) diffuse out of the Pd-black particles and are measured by the two QMS units.

Deuterium is an isotope of hydrogen and shares its chemical activity; it is captured by the getter and removed from the "Closed QMS" system in a period of minutes. Helium is chemically inert. It is not absorbed by the getter and remains in the system. Deuterium gas (D_2) and ^{4}He have nearly equal masses, but the QMS is able to distinguish between them. While D_2 is present, it serves as a calibration marker. It is important to understand that helium is nearly insoluble in palladium; therefore, any helium appearing in the "Closed QMS" system must come from

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within the Pd-black, and so must have been created from deuterium by a nuclear process.

Fig 5 shows a graph produced by the QMS. It is set to repetitively scan over a narrow range centered on a mass of 4. Any particles whose mass is near four times the mass of a hydrogen ion will register, the vertical height being the intensity, or population at that mass number. The sample is heated for about a minute in the evacuated system, with only the getter and sample chambers open. The valves into the QMS are then opened. At this point surface contaminants evaporated from the sample surge into the QMS, producing the hump. Yet, very strong peaks from the D_2 desorbed from the sample are seen. These give an immediate calibration to the QMS display. Very small peaks at the left edge of the D_2 peaks are initially seen, which is where ^{4}He is expected. By the fifth minute the getter has absorbed enough of the D_2 that its signal is reducing and the ^{4}He signal remains, even growing stronger as it continues to come out of the sample but is not absorbed by the getter. By the ninth minute the helium signal dominates, as seen in Fig.6.

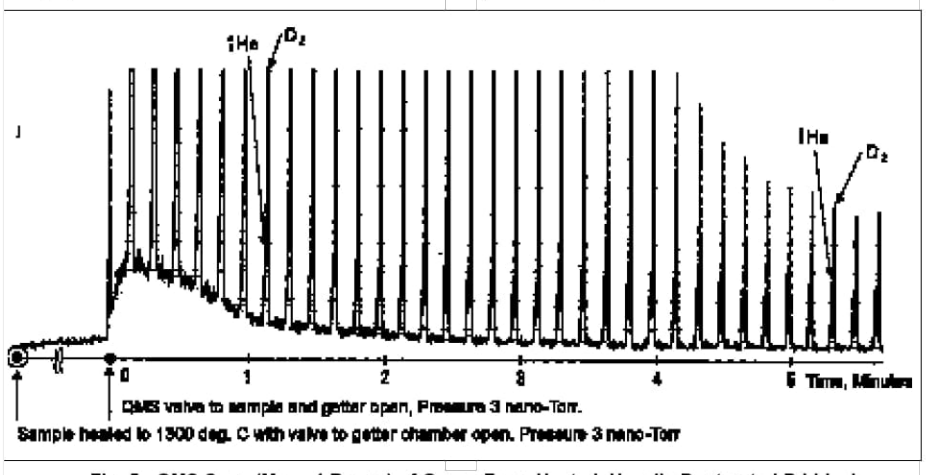

Fig. 5 QMS Scan (Mass 4 Range) of Gases From Heated, Heavily Deuterated Pd-black

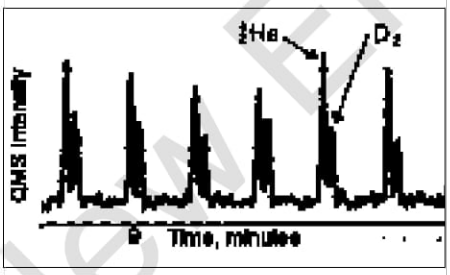

Fig 6. D_2 - ^{4}He Mass Spectrum After 9 Minutes

The sample heater is then turned off, and the system allowed to cool to room temperature, with the getter chamber still open.

At 67 minutes, the Mass 4 spectrum, shown in Fig 7, now shows only one peak, that of ^{4}He.

In Fig. 8, the second QMS is tuned to the Mass 3 range, and at 67 minutes shows ^{3}He with a marker of the compound DH, whose mass is nearly 3. The DH is mostly absorbed by the getter at this point, since it is chemically active.

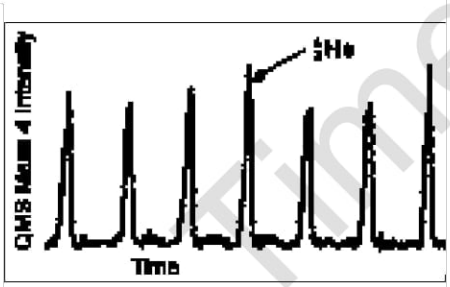

Fig. 7 QMS Mass 4 Spectrum After 67 Minutes. System at Room Temperature

In these graphs we see clear evidence of two isotopes of helium being driven from within the Pd-black particles. It is important to understand that helium is virtually insoluble in palladium. Helium which appears and remains in a sealed system as all chemically active gases are absorbed by the getter must have come from within the Pd-black sample, created there by the reactions which also generated the excess heat. The graphs shown here are for a particular sample but are representative of about a dozen samples whose mass spectra are shown in the 1997 HTS paper.

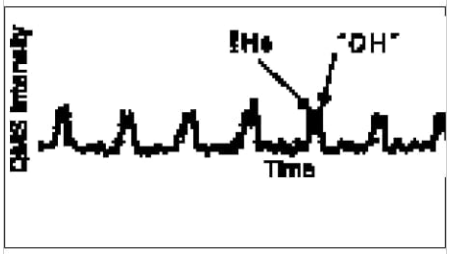

Fig. 8 Mass 3 Spectrum After 67 Minutes. System at Room Temperature

Anomalous Heat and Ash: A New Nuclear Reaction

It is now time to review. A&Z built an electrolytic cell using heavy water with a cathode consisting of a sealed palladium capsule containing a few grams of Pd-black. Over a period of 4800 hours this cathode generated several hundred megajoules of heat energy above and beyond the energy necessary to run the cell. At the end of the run, the Pd-black was removed and heated in a sealed mass spectrometer which showed that ^{4}He and ^{3}He had been created within the Pd-black. ^{3}He is rare in nature, and neither isotope of helium readily dissolves in metals.

Helium and heat are two signatures of the deuterium fusion reaction. Table 1 lists the reaction products of the expected Rutherford DD reaction. A&Z's reaction does not match the signature of the Rutherford reaction, yet the heat energy release places it completely outside of any chemistry. Further, A&Z found no tritium in tests outlined below.

These results meet the critical demand for coupling of heat and nuclear ash in one experimental context. It is good news that the heat energy comes without intense radiation or radioactive ash. It is bad news for conventional physics because the experimental results do not match any known DD reactions. A&Z propose that in a palladium lattice saturated with deuterium, intense local vibrations ('lattice quakes') and microplasmas may occur which enable novel fusion reactions to take place.

Details, Details, Details

Confidence in A&Z's results comes from careful study of their work, which began before the F&P announcement in 1989. We will now turn to details which aid in understanding the thoroughness of their work.

Calorimetry Questions

There are a number of questions to be answered about the calorimetric data shown in Fig 3.

1) What causes the short term variation in the heat generated, that looks like noise?

2) What are the operating parameters of the cell: voltage, power, temperature differential, coolant flow?

3) Are the temperature measurements representative of the significant tempera-

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tures in the cell?

4) What causes the large scale variations in heat generated; the burst at 1800 hours, the drop at 3700 hours?

5) The cell input power is in the range of a hundred watts, the excess is a few watts. How can we be confident that the results are not artifacts of a poorly constructed experiment?

6) Does the cell respond to changes in external parameters?

Short Term Variation and Operating Parameters

The Y-axis of Fig 3 gives energy in kilojoules/hour (KJ/hr), where one watt-hour is 3.6 KJ. The graph is normalized such that zero on the Y-axis is the input electrical energy for every plotted point; the distance above the zero line is "excess energy." The X-axis is process time, in hours. The experiment ran for about 4800 hours. The data is very crowded, but plots of other experiments indicate that data is recorded at least hourly, if not more frequently in some cases. Automatic data logging equipment was used.

The short term variations are present whenever the cell is powered. A&Z offer no explanation for this, but a hypothesis which fits the facts is as follows:.

As I mentioned above, heat energy is carried in the evolved gases into the recombiner at the top of the cell. The catalyst causes heavy water to form, releasing energy as heat. This water is not immediately returned to the electrolyte pool, but may be retained for a time (as atmospheric moisture may accumulate in a cloud) before "raining" back into the electrolyte, returning the heat energy lost. This process may be quasi-cyclic, producing cyclic variations in the temperature differential measured and the apparent instantaneous heat output of the cell. Since the interval between plotted points is probably not that of this quasi-cyclic process, irregularity in the plotted values can be expected. This is an artifact of the electrolysis process both in the calibration with the platinum cathode and in operation with a palladium cathode. It disappears whenever the electrolysis power is turned off, even though heat production may continue in the case of the DS cathodes.

Support for this hypothesis is in Fig. 10, which shows temperature measurements made in the capsule and in the proximate electrolyte. There is a cyclic variation of about 1° C peak-to-peak, with a period of about six minutes. The plotted oscillations are so nearly in phase that it is not possible to determine if the variations originate within the capsule or in the proximate electrolyte in the cell. Only a few millimeters of palladium and some electrolyte separate the two probes. It is not clear what processes within the capsule, or at the capsule-electrolyte interface, could cause such cyclic variations. Variations according the above hypothesis, producing changes in the electrolyte temperature, might be conducted to the capsule interior within the time scale shown.

There may be other processes at work. All measurements are not available. The electrolyte pool is well mixed by convection currents and bubbling, which should not show cyclic variations of the type seen.

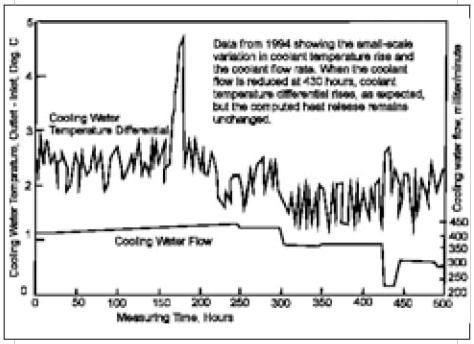

Fig .9 Coolant Temperature Differential and Flow Rate for a DS Cathode

Fig 9, from a 1994 paper, gives us more information. Here the short term variation is plotted in terms of the differential temperature between inlet and outlet cooling water. The variations fit within an envelope ~0.8° C. We also find a value for the range of water flow, a few hundred milliliters per minute. We also see that when the flow is cut, the temperature differential rises, as would be expected. The computed power yield is unchanged. The measurement changes in response to a change of parameters and is thus not a self-generated artifact.

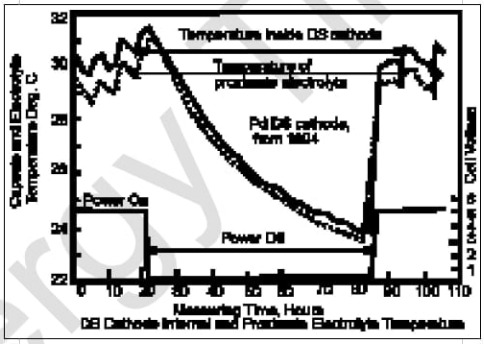

Fig. 10 Capsule Interior and Proximate Electrolyte Temperatures and Cell Voltage

One critic speculated that boiling might occur in the cell, creating a froth that might cause irregular measurements. Fig. 10 shows data from another test in 1994 in which temperature inside the DS and in the electrolyte just beside the capsule were measured. The absolute temperature in the range of 28-30° C, well below boiling, and the temperature inside the capsule is only a few degrees higher than the surrounding electrolyte. A cyclic variation in temperature is seen while the cell is operating, which may be due to the "raining" of condensate from the recombiner or to another, unidentified cause, as discussed above.

Note that the variation disappears when electrolytic power is shut off, with an exponential decline in heat production over a period of tens of hours, as one would expect from the depletion of deuterium fuel in the CF reaction.

Representative Measurements

A criticism made of some CF experiments is that thermocouples used measure temperature at only one, rather small, point, which may not be representative of the whole cell and by being at a fortuitous 'hot spot' may give over-optimistic results. I should mention that this criticism is not valid for other, more recent CF experiments, and has no bearing on the A&Z cell.

Fig. 1 shows the capsule centered at the bottom of the cell. Electrolyte warmed by the internal heat of the capsule rises in a plume to the top of the pool and returns down the outside, a path that encloses the coil in which the cooling water circulates. In addition, gases bubbling from the cathode and anode will further mix the liquid.

Cooling water enters the cell by a coiled tubing which reaches down to the top of the anode. Inlet and outlet temperatures are measured by two pairs of thermocouples. One pair provides independent measurements of the inlet and outlet temperatures. The other pair, connected in opposition, directly measure the temperature differential and thereby the heat produced within the cell. While these are indeed point measurements, the flow rate of ~300 ml/min indicated in Fig. 9 assures mixing of the water stream, which itself is exposed on all sides to the electrolyte and is thus representative of the heat produced within the cell.

Power Input and Output

Fig 11 is a cross-check on the calibration procedure noted above. Here is a new cathode, placed in a cell, and for 250 hours the output power closely follows the input power, with some very small variations seen in the output power. The Y-axis scale is in KJ/hr, where 1 KJ = 3600 Watt-seconds. Here one Joule = 4.2 (time,

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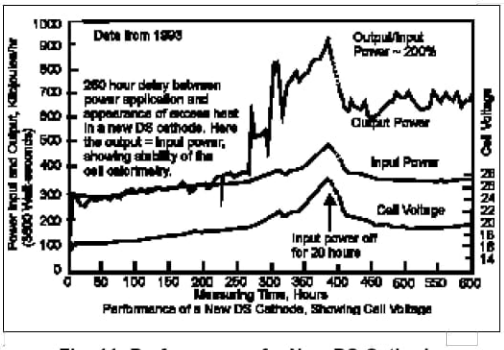

Fig. 11 Performance of a New DS Cathode, showing Cell Voltage

seconds) (volume of water) (temperature differential).

Then, suddenly, the reaction ignites and the output power is double the input power for hundreds of hours.

At one point the input power is turned off for 20 hours. The reaction does not immediately quit, but declines rapidly. Once again, the heat production

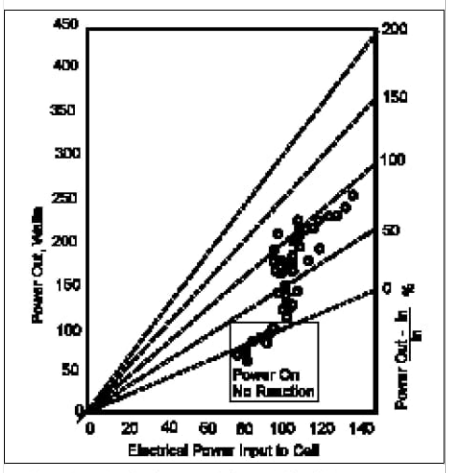

Fig. 12 Heat Power Out vs. Electrical Power Input for the DS Cathode of Fig. 11

responds to a change in an external parameter, the power input to the electrolysis. The cell voltage is in the range of 15-30 volts.

Fig 12 shows the relationship between cell input electrical power and the heat generated, both given as watts, for the cell above. Note that before the reaction ignites, there is no excess heat. During the ignition period, there is a rapid rise in heat output without much change in input. After that, there is proportionality between the excess heat generated and the input electrical power. We will see later that this is consistent with other measurements which show that the rate that deuterium ions enter the Pd-black is proportional to the cell current.

Large Scale Variations

The large scale variations in excess heat shown in Fig. 3 were a puzzle during the early study of the A&Z work, and led one critic to characterize the data as "jumpy" or "noisy." Since the internal processes in the capsule are not well understood, it is possible that the large scale variations are the result of unknown factors — which do not invalidate the salient fact of energy yield. I suggest a plausible source of the short term variations above. The source of the long term variations may be equally mundane: A&Z simply changed the cell input power. The graphs from papers dating back to 1994 show that A&Z changed the operating parameters during a run, apparently to explore their effect on the process. Several of these are shown in this article. There are also other plots of the type of Fig 12, showing a strong correlation between cell power and output power. We don't have an input power plot corresponding to Fig. 3, but it is credible that A&Z simply increased the cell input power gradually from ~2500 to ~3500 hours, then cut it back to a lower level. The drop at ~3300 hours is abrupt on the graph's time scale. Taking Fig. 10 as a model, the capsule temperature fell to that of the cooling water in ~60 hours, which would be a vertical line on a scale spanning 5000 hours.

Calorimetry Summary

We have answered the six questions posed above with evidence that the calorimetry is valid, that there are straightforward explanations for the small and large scale variations in the data, and have discovered reasonable parameters for the operating conditions. We can accept one major claim by A&Z: their DS cathode produces strong, sustained excess heat output of the order of megajoules per cc of active material.

The Search for Tritium

A QMS cannot directly distinguish tritium from Helium 3. Tritium is an isotope of hydrogen, with two neutrons and a proton in the nucleus. Helium 3 has two protons and one neutron. The two atoms have virtually identical masses. Tritium can form compounds with hydrogen, deuterium, and oxygen, but ^3He forms no compounds, being a noble gas. If the Rutherford reaction is producing the excess heat, equal amounts of tritium (T) and ^3He should be produced. The tritium can be expected to form compounds such as T_2, T_2H, TH_2, DT, D_2T, etc. at mass numbers 5,6,7. QMS runs were made with Pd-black which had generated heat in a test cell, and with Pd-black not loaded with deuterium. The QMS signals at the mass ranges 5,6,7 were the same for the deuterated and non-deuterated samples, indicating that no tritium had been produced by deuteration and heat generation in a test cell. The absence of tritium compounds is taken as further evidence that the Rutherford reaction is not involved.

The QMS graphs for this test are included in an appendix. They are complex and require careful study.

The Special Qualities of the DS Cathode

As noted above, the cathode properties are key to the performance of F&P cells. A&Z claim special advantages for their DS construction, indeed they were one of the first to show sustained, substantial heat production in a Pd-heavy water cell. The key ingredient is colloidal palladium, or Pd-black. It can be prepared by precipitation out of solution by a chemical reaction, or by electrically exploding a wire of palladium in an argon atmosphere (Argonide Corp.). The process used by A&Z is not known, but they claim a particle size range of 20 to 60 nm with an average of 40 nm. I have calculated for cubic particles 40 nm on a side, that the surface area of one gram of palladium is some 8300 square meters. This greatly enhances adsorption of deuterons.

Fig 13 shows pressure buildup in a stainless steel pressure vessel simulating a DS cathode, with a capillary leak of deuterium gas. If the vessel is empty, the pressure buildup follows a straightforward trend. If the vessel is filled with nickel powder, the pressure rises more rapidly at first because the powder

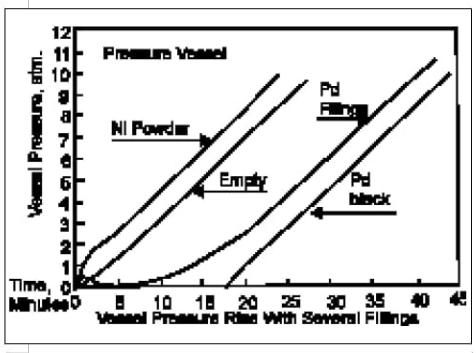

Fig. 13 Pressure Buildup in a Stainless Steel Pressure Vessel with Several Fillings

reduces the effective volume of the vessel and does itself not absorb deuterium gas. The nickel curve remains above that for the empty vessel, since the effective volume is reduced. If the vessel is filled with palladium filings, the pressure initially follows the trend for nickel, but then drops as absorption takes over, yet soon rises as the surface of the particles is saturated. With Pd-black, the very large sur-

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face absorbs the gas completely until saturation occurs; then the pressure rises with the same trend as the empty vessel, but with a large displacement representing the absorbed gas. With a hollow palladium cathode, the diffusion of deuterons through the walls of the capsule is the equivalent of the leak in the previous experiment.

Fig. 14 shows the relationship between cathode current and cavity pressure for a particular cathode.

The first curve, for a cathode current density of 640 ma/sq.cm., is of special interest. There is an incubation time of ~0.8 hours from the start of cathode current to the start of pressure rise inside the capsule cavity. This is the time required for deuterons to diffuse through the capsule wall. The incubation time and rate of pressure buildup are both functions of the cathode current density.

When the cavity is filled, the pressure-time characteristic changes. In the usual solid cathode, deuterons migrate inward from all surfaces until the beta phase concentration is reached. The A&Z cath-

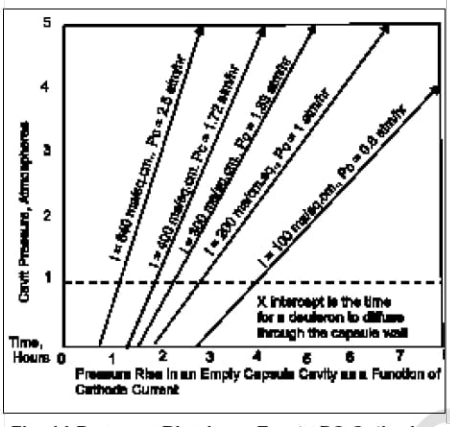

Fig. 14 Pressure Rise in an Empty DS Cathode as a Function of Cathode Current Density

ode has a cavity in its center, which makes a large difference. Deuterons reaching the inner surface face a potential barrier; they must find another deuteron and some electrons to form D_2 gas before they can leave the surface. Extra electrons are plentiful, for the capsule is a cathode and supplied with electrons by the external power source.

Spillover: Deuteron Surface Migration

Deuterons reaching the cavity wall can migrate over the surfaces of the packed Pd-black particles without surmounting the energy barrier to combine to produce D_2 gas. This migration is called *spillover*. For some time its existence was doubted in the chemical community. There now have been three international conferences on spillover, the last in 1993. The effect of spillover is seen for a DS cathode in Fig. 15

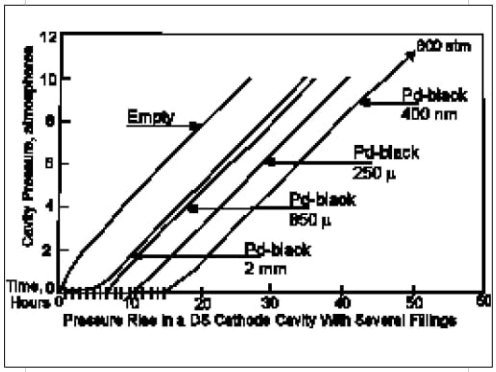

Fig. 15 Pressure in a DS Cathode with Several Fillings, Showing Spillover

The empty cavity shows negligible incubation time. The current density for this experiment is not stated. With 2mm Pd beads, the pressure rise is similar to the case above with filings. As the particle size is reduced, the incubation period increases as the deuterons are absorbed in spillover migration across the surface of the Pd-black particles.

At the surface of the particles, energy is required for deuterons to combine into D_2 gas. The pressure rise will not begin until the surface is saturated with deuterons. Deuterons can diffuse into the particle lattice without surmounting the en-ergy barrier necessary to form a gas.

Note that Fig. 11 showed a 250 hour period between starting a new cathode and ignition of the nuclear process. This is much greater than the incubation periods discussed here. A&Z do not discuss this. When power is switched off, the pressure in an empty cavity falls faster than in a cavity filled with Pd-black, as shown in Fig. 16.

Here a DS cathode was operated with a current density of 640 ma/sq. cm. until

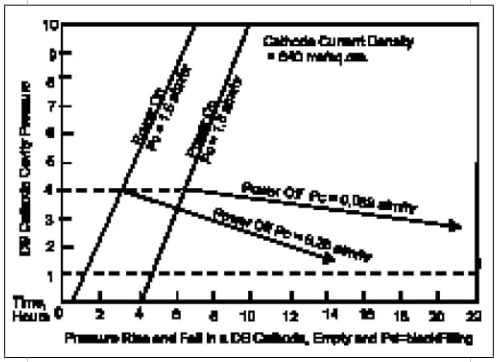

Fig.16 Pressure Rise and Fall in an Empty and Filled DS Cathode

the internal pressure reached four atmospheres. The power was then shut off and the pressure allowed to decline. The incubation time and pressure rise/fall rates are shown in the figure. The effect of the Pd-black is seen again, both in increasing the rate of pressure rise, but more significantly in the reduced fall rate. When the power is off, the electrochemical potential driving deuterons into the cathode is gone, so deuterons within the cathode, including the cavity and the Pd-black, can diffuse outward. The substantial quantity absorbed will take longer to escape.

Pd-black Surface Contamination

A&Z mention that the Pd-black can be coated with surface contaminants from a few to ten atoms deep, comprising as much as ten percent of the particle volume. This remark most likely pertains to the 40 nm size, which is only a few hundred atoms across. This surface contamination is burned off in the early stages of the sample heating in the QMS.

Pd-black Melting

A&Z provide electron microscope images of 40 nm Pd-black before and after processing, which are shown as Figs. 17 & 18 Before processing, the particles have a distinct granular appearance. Afterward, the shapes are softened, as if by partial melting, with no evidence of internal cracks. Thus there is evidence for locally elevated temperatures, consistent with nuclear reactions.

Summary

The work of Arata and Zhang is one of several landmarks in the evolution of the Fleischmann & Pons discovery. From as early as 1990 they obtained robust, strong excess heat results with their DS cathode and went on to demonstrate clear evidence of nuclear re-action ash in the processed Pd-black powder. Criti-cisms of earlier F&P-class experiments have been answered or surmounted by the experimental procedure and apparatus.

Acknowledgments

Stimulus for careful study of the A&Z materials came from debates on the Internet Vortex-l forum with Kirk Shanahan and Rich Murray (who provided me with an English version of a 1994 A&Z paper). Thanks also to Akira Kawasaki for a painstaking translation of a Japanese version of the 1994 paper. Jean-Paul Biberian provided some valu-

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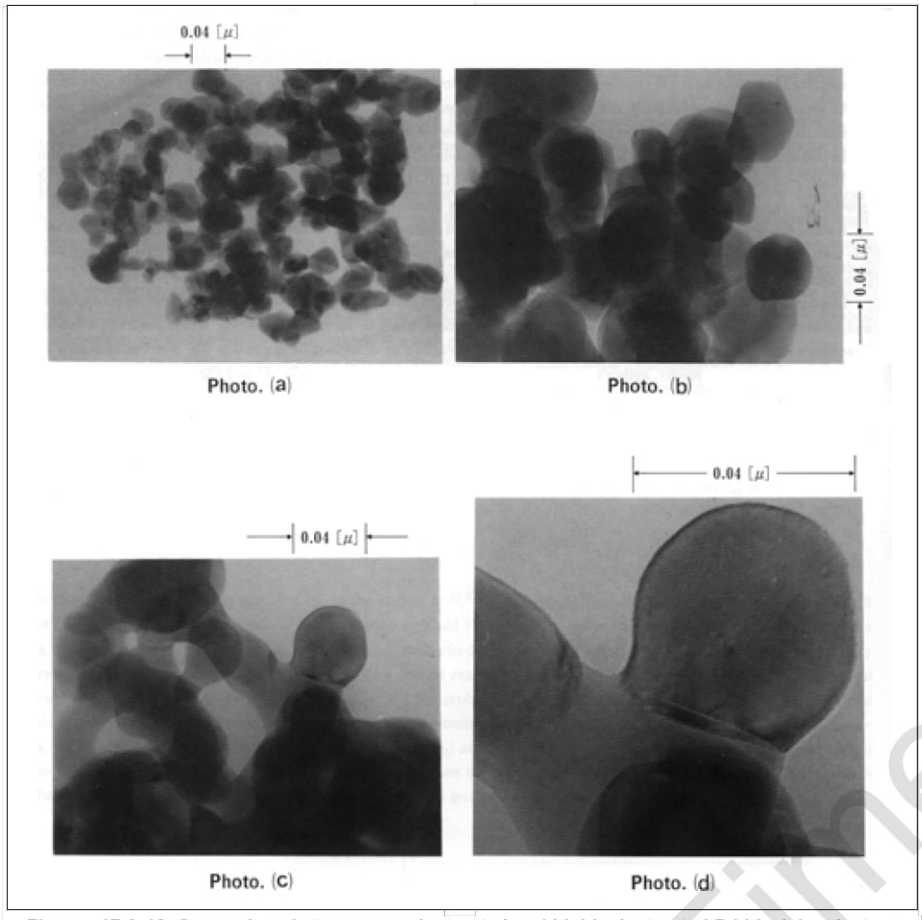

Figures 17 & 18. Comparison between non-deuterated and highly deuterated Pd-black by electron micrograph. Photo (a) and (b) are non-deuterated sample. Photo (c) and (d) show the highly deuterated sample.

able commentary on the spillover phenomenon. Peter Glück pointed me to a paper on spillover in the chemical literature.

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2. "A New Energy Caused by 'Spillover Deuterium'," Yoshiaki Arata and Yue-Chang Zhang, *Proceedings of Japan Academy*, 70, Ser. B (1994).
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Figures:

Fig. 1: Fig. 5, Ref 1
Fig. 2: Fig. 6b, Ref 1
Fig. 3: Fig. 8a, Ref 1
Fig. 4: Fig 19(a), Ref 1
Fig. 5: Fig 22[III] (A), Ref 1
Fig. 6: Fig 22[III](A), Ref 1
Fig. 7: Fig 22[III](Ba), Ref 1
Fig. 8: Fig 22[III](Bb), Ref 1
Fig. 9: Fig 2a, Ref 3
Fig 10: Fig 4(A), Ref 2
Fig 11: Fig 1(A1), Ref 2
Fig 12: Fig 1(A3), Ref 2
Fig 13: Fig 6(B), Ref 2
Fig 14: Fig C(a), Ref 2
Fig 15: Fig 7(a), Ref 1
Fig 16: Fig 6(a), Ref 2
Fig 17: Photo (a) p40, Ref 1
Fig 18: Photo (d) p40, Ref 1
Fig 19: Fig 17, Ref 1

Appendix A: Testing for Tritium

As mentioned above, tritium and helium 3 cannot be distinguished by QMS, for the masses are nearly equal. A&Z looked instead for compounds of tritium by comparing mass spectrometry of deuterated and non-deuterated samples. This work was done before they built the closed QMS system discussed above.

Conventional mass spectrometers use an attenuated flowing gas stream containing a known calibrating gas plus the specimen gas. The gas flows past an ionizing structure and into the exhaust pump. Ionized particles are drawn into the electric and magnetic fields which sort them by charge and mass. Where helium is the species of interest, as in the present case, the large volumes of carrier gas used may well be contaminated with ambient helium, which has led to doubt about claims for helium in F&P-class experiments. Under high vacuum conditions, it is also possible for particles (molecules and atoms) to escape from the vacuum pump inlet and migrate into the vacuum chamber; this is called *back pressure*. Such migration is another pathway for helium contamination.

F&P improved on the conventional mass spectrometer by introducing a controlled leak of a known gas into the inlet port of the pump. This leak provides a stream of molecules which sweep escaping molecules back into the pump. Some of these leaking molecules can also diffuse to the mass spectrometer, but the species is known and can be neglected in analysis of the results. A&Z refer to this as a "limited QMS." Limited QMS gave A&Z the first look at the mass spectrum of deuterium and helium-4 together. It was also used to produce the data of Fig 19 below.

Because of the complexity of the data in this figure, I have made no attempt to trace or clarify it, but offer a guided tour. What is presented are the intensities of QMS target currents for mass ranges from 1 to 20, taken with highly-deuterated (*) and non-deuterated (open circle) samples. The test period is a bit over 15 minutes. The QMS is operated in a low resolution mode, which shows only the gross features of the spectra, not the details shown elsewhere. Note the extreme dynamic range, over seven orders of magnitude.

For each mass value, possible isotopes and compounds are listed. Most of these show an expected trend with time; a burst of signal as the sample is heated and contaminants burn off, followed by a steadily declining signal as the heating and pumping proceeds.

In this experiment A&Z present the evidence against the presence of tritium in their processed Pd-black samples. Tritium is abundantly produced by the Rutherford reaction and compounds of tritium would be present if produced. These would be at mass 5,6,and 7. Note that the traces for the deuterated and non-deuterated cases overlap at the noise level for these masses, and that the tritium compounds have been "Xed" out. The trends for mass 3 and 4 are different from the others and require closer consideration. Many compounds of H, C, and O are possible assignments for the mass traces. A&Z do not provide an extensive discussion of these, so my analysis is as follows:

Surface contamination of the Pd-black may consist of water and an undefined blend of

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organics. As the sample is heated up to 1300° C, these will evaporate and dissociate and recombine in the effluent vapor into simpler compounds. Deuterium is present in nature in a con-centration of about 0.01% that of hydrogen. Deuterium is thus present even in the non-deuterated samples. The essentially level output with time of the non-deuterated trace at mass 3 is assigned to DH and its source may be from the larger mass of ambient D in the surface contamination which winds up as DH in the chemical reactions involved with the heating. The non-deuterated mass 4 trace rises with time. It is assigned to D_2 and is the expected four orders below the H_2 levels. It rises with time, which may be due to dissociation of larger molecules containing D by the sample heating. Note that for both mass 3 and 4, the highly deuterated samples from the cathode show levels of mass 3 and 4 nearly an order of magnitude higher than for the unprocessed samples.

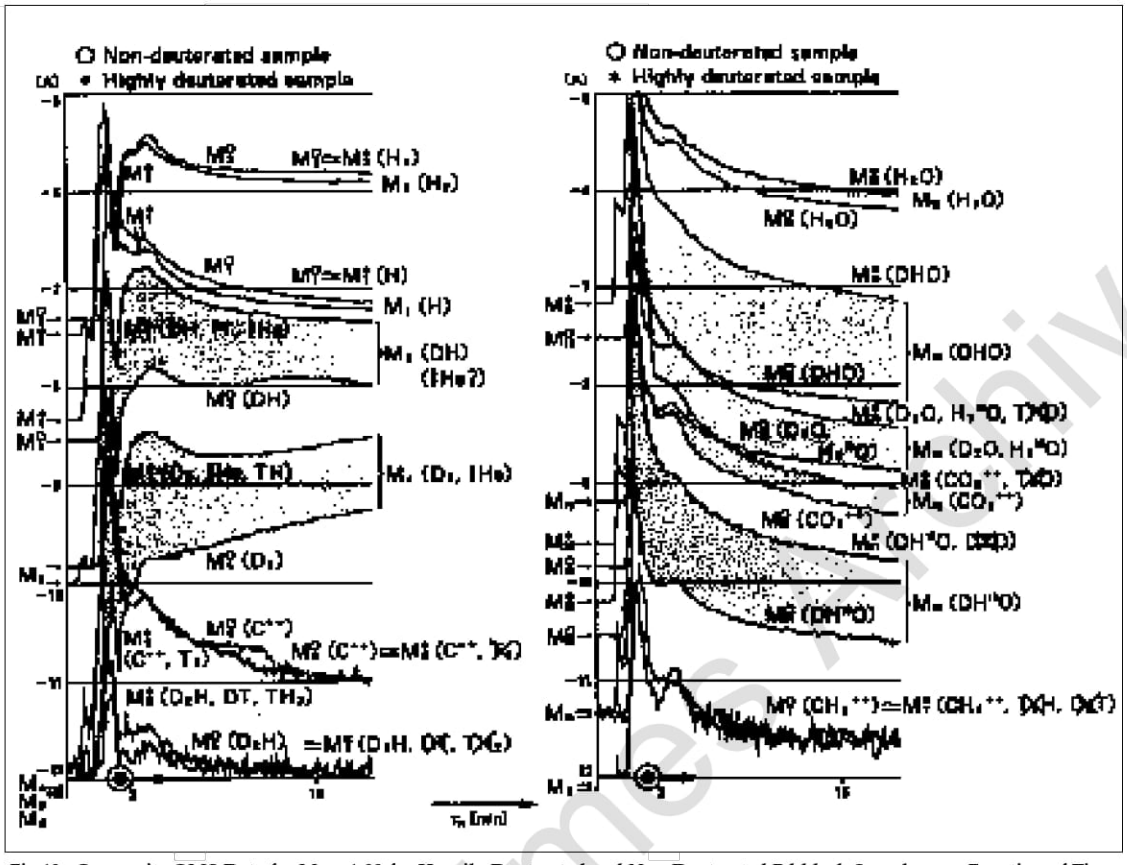

Fig.19. Composite QMS Data for Mass 1-22 for Heavily Deuterated and Non-Deuterated Pd-black Samples as a Function of Time, Using "Limited QMS" Procedure

Appendix B: Determination of ^{4}He / ^{3}He Ratio

Mass 3 contains both ^{3}He and DH. They can be separated by selection of the ionization potential of the QMS. Below 24.5 V, the hydrogen isotopes and compounds such as DH are ionized. Above 25 V, the helium series, including ^{3}He and ^{4}He are ionized. By a series of comparative measurements, A&Z determined that four parts of ^{4}He are produced for every 3 parts of ^{3}He. This is also direct evidence against the Rutherford reaction.

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Editorial continued from p. 24

able, the game will be over for the Science Establishment. It will have no choice whatsoever but to cover this work seriously and *plead* for your submitted papers to *Science* and *Nature*.

Who knows, our dear Dr. Douglas Morrison of CERN, who perennially asks when he will be able to have his "warm cup of tea" from a cold fusion reactor (not understanding that *right now* such devices exist at several cold fusion/new energy companies), might even stop coming to these conferences. He might stop writing from the viewpoint of his hobby specialty (apart from neutrino detection) —"pathological science." As we all know, Morrison's reports influence journalists and scientists. This makes a mockery of your work. So why not give him something truly different to write about — that warm cup of tea.

Rounding out this Big Picture, we are going to leave you with a warning, of sorts: Don't think you have forever to carry out your jobs as scientists and engineers in this field. You have a responsibility to bring your work to a dramatic turning point as soon as possible. If you don't do so, you may well wither and fall by the wayside.

We don't want that to happen to you, but it might. You are all heroes, so be heroic in the final stretch. There are commercial activities and demonstrations in this field that *are* going to make dramatic progress — so much so that these may cast *your* efforts in a less publicly significant light. To some extent this has happened already, and this may have been inevitable. For example: For technical reasons, excess heat devices that use ordinary water have been far more successful than heavy water-palladium.

There is a social and ethical imperative here too. The world *desperately* needs you to break through and show it that a technological and scientific new age is about to dawn. Millions are hungering for this Millennial Hope: cheap energy, clean water, and an end to atmospheric pollution. You have the power to give this Hope. Open your minds, open your hearts, grasp the Big Picture, and Race to Victory. Good luck to you all...

April 25, 1998, 9 a.m. to 4 p.m.
Illustrated talks on Cold Fusion and New Energy
by
Dr. Eugene Mallove at Portland State University,
Cramer Hall,
Rm. 71, 1721 Southwest Broadway
Portland,Oregon
Sponsor: Citizen's Information Network
Contact: 503-237-3293
**** Preregistration required ****

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Enter "Miracle Number Two"

Electrochemical Activation

by Eugene Mallove

I have encountered at least two "miracles from water" in the last decade. The first one I heard about on March 23, 1989—the announcement of cold fusion. The second one—the "Electro-Chemical Activation" (ECA) process fully penetrated my consciousness on February 9, 1998—though I had had the material about it lying around on my desk since April of 1997! This shows how even scientific "miracles" can get lost in the "data fog" of the Information Age. Had I not been organizing the vast piles of information on this editor's desk, and had my mind not been prepared by the cold fusion wonder, "*Miracle Two*" might have remained dormant for who knows how long.

What is Miracle Two — the ECA process? Simply, it is an almost unthinkably remarkable property of specially electrochemically processed water that has apparently been known for the last twenty-five years in Russia. With a minute energy input, it totally decontaminates water of all harmful organisms (single-celled as well as viruses) and removes toxic heavy metals, leaving good ions — such as Na^{+} and Ca^{++} alone. The energy input into this is far, far below what would be required to boil and filter that water by conventional means. That is *only* "Part A" of *Miracle Two*.

In Part A, about one gallon of purified water can be made in less than 5 minutes. The battery from an automobile is adequate for powering the process. The truly astonishing "Part B" is that this one gallon of water may then be mixed with 100 gallons of water of impurity and toxicity equal to the original bad water and it will sterilize that entire volume of water!!! The total time to make 100 gallons of bacteria-free water is thus under 15 minutes. Solids are removed by settling, but the top layer of the tank of sterilized water is immediately drinkable.

To be blunt: the pure water in the one gallon of Part A has apparently been made into one of the most potent sterilization solutions known to man. It can be used in hospitals and be directly applied to wounds to sterilize them. In fact, wounds have been shown to heal faster with application of this processed water. (Talk about the healing properties of water!) A surgeon would not even need to operate with gloves: as long as his or her hands remained wet with this sterilizing water, the bacteria that came in contact with the wetted hand (from air or surfaces) would be killed instantly. Variants of the process have been developed that make such potent sterilized water that the water may be inhaled as aerosol and it will kill tuberculosis germs in the lung. Some three million people a year die from tuberculosis today. Maybe they will soon be saved.

Yes, the sterilizing solution can be

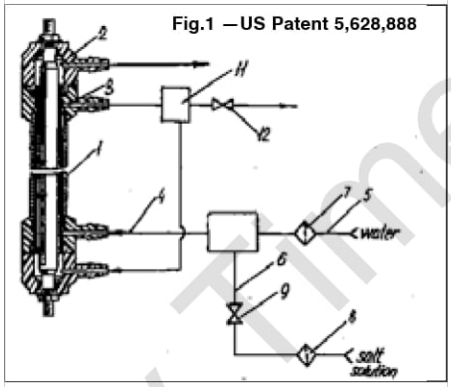

Fig.1 —US Patent 5,628,888

drunk – though you may get diarrhea from it because it kills the good intestinal bacteria, but it will not harm the multicellular intestinal wall of your gut. Small price to pay for killing off anything nasty down there as well, one might think. There are applications in washing and cleaning of food in the meat and vegetable industries. The sterilizing water will not kill large organisms such as fish or insects.

The process is in widespread use in Russia — some 60,000 units are in place. The process *is* also aboard the Mir Space Station! The cosmonauts use a small centrifuge aboard Mir to remove the objectionable solids that are left after the sterilization process.

The technology was discovered in Russia some 25 years ago and there are said to be tens of thousands of ECA units in Russia and in CIS states. Russian troops used the water-pruifying technology as a matter of course in Afghanistan. It has now been fully validated by scores of Russian scientists and it is ready to be unleashed globally for the betterment of humankind — but for some mind-boggling institutional obstacles. It is the cold fusion story all over again, albeit in quieter form.

In my view, it may even be related *scientifically* to cold fusion through some as yet dimly perceived physical mechanism. This story would not even have emerged were it not for the ending of the Cold War and the need for Russian scientists to be paid via private means. The Russian government no longer funds the work directly.

The ECA process for the last several years has been in the hands of highly competent scientists at Monsanto Corporation in the U.S. — who have totally verified it. A color brochure from Monsanto's Enviro-Chemical Division describes its salient characteristics, with sufficient detail to know that this is, indeed, a heretofore unknown property of specially processed water (see attached text from this brochure).

The ECA work originates with a small company, RSCECAT, USA, Inc., in Nevada. The acronym stands for the Russian Scientific Center for Electrochemical Activation Technique —the small company that has licensed the technology to Monsanto. Three U.S. patents have been granted and five more have been applied for according to a senior official at RSCECAT Robert Yukes.

These are the patents: U.S. 5,427,667 (granted June 27, 1995, "Apparatus for Electrochemical Treatment of Water"—Vitold M. Bakhir *et al.*); U.S. 5,628,888 (granted May 13, 1997, "Apparatus for Electrochemical Treatment of Water and/or Water Solutions" Vitold M. Bakhir *et al.*) and U.S. #5,635,040, "Electrochemical Cell" Vitold M. Bakhir et al).

It has been suggested that Monsanto may be balking at widespread commercialization, not because the technology is not promising (far from that!), but because Monsanto may fear a repeat of the "thalidomide" story: if the sterilizing water is not tested over long periods, who knows what bad side-effects might emerge, or so the company may think. I personally would feel that the benefits far outweigh the hazards — especially since the lives of some 30,000 people are being lost each day worldwide due to contaminated water (see *Infinite Energy* editorials by Dr. Dennis Cravens and Eugene

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Mallove in *IE* #17.) And is it not easy to test the ECA water on thousands of rats quickly?

One power company apparently had the process installed on its cooling water effluent. It worked very well and replaced the toxic chemicals that were being used to sterilize the water. However, because of chemical industry financial pressure the power plant wanted nothing further to do with the new process....old ways die hard.

Good news is on the way. On Friday, March 13, 1998, representatives of RSCECAT met with the Minister of Health of South Africa (Dr. Zuma). The South Africans were hosting RESCAT scientists as well as scientists from the Russian Ministry of Health. The process has been in use in South African Hospitals for the past year and reports of effectiveness are highly positive.

There is a cholera problem in South Africa and this process can help stop transmission of the disease. There is a strong signal that the process will be widely adopted in South Africa, and that this will be the beginning of the end of the institutional obstacles that have been faced so far in the paradigm-paralyzed Western World. I am sure that one of the main reasons for Monsanto's reluctance must be that the company really has no good explanation for the process in terms of conventional science — at least none that would hold any water according to accepted physical theories.

Now, what is this going to do to modern physics and chemistry — to say nothing of medicine and microbiology and all that? How are we going to explain that there is only 300 ppm of Cl^- ion (among other low ppm ion concentrations), yet the water solution is acting as a sterilizing solution of potency 50,000 ppm Cl^-, *i.e.* concentrated bleach?

The first thing an open-minded person may think about when hearing this story is: Is there any relation to the homeopathy ("memory of water") experiments of Jacques Benveniste? Those experiments, reported in *Nature* in 1988, and later inappropriately trashed with extreme bigotry by editor John Maddox and magician James Randi *et al.*, might have some bearing on this. Is there some kind of electromagnetic "signature" being impressed on the water in the electrochemical process? Dr. Benveniste now audaciously claims that the memory of water signal (whatever that is) picked up by coils, can be transmitted electromagnetically through wires to impose itself on other batches of water. In fact, this very experiment was demonstrated on the BBC Heretic television series in 1994. It is understood that Dr. Benveniste is linked with firms that intend to commercialize the effect and have a virtual pharmacopoeia of medicine transmitted over wires. Of course, bigots like Maddox and James Randi are laughing, but I trust that Dr. Benveniste will have the last laugh. Are there some unusual aggregations of water molecules being created? There are several theories that have been proposed to explain the effect, but none of them really cut the mustard -- or hold water (get used to that pun).

Let's face it, this really breaks (nay, demolishes) paradigms — physics, chemistry, biology, medicine — everything. This electrochemical process has GOT to have analogs in natural biological systems — shedding light perhaps on how they function and on how they work to fight disease in ways heretofore unexpected. Oh, how this will anger those who have battled against "Alternative Medicine." Too bad for the pardigm-paralyzed Medical Establishment — good riddance!

The beauty of ECA is that it is commercially available NOW and should spread like wildfire soon. We would like to think that *Infinite Energy* magazine had something to do with that. In the process, the success of ECA may knock the arrogant Scientific Establishment where it belongs, onto its Big Fat Behind (you should excuse the euphemism). Millions of lives will be saved and Science may never be the same again. But do not underestimate the power of "Business as Usual" to keep this out of the public arena for a long time. —*EFM*

1996 Press release from Monsanto:

FOR IMMEDIATE RELEASE

Monsanto licenses innovative water technology

CONTACT: Patricia Hallmark 314-275-5937

St. Louis, MO, October 1, 1996 -

Enviro-Chem Systems, Inc. announced today the recent completion of a licensing agreement with RSCECAT USA, Inc. of Las Vegas, Nevada. The agreement provides Enviro-Chem Systems with exclusive rights to RSCECAT patents and know how for the innovative water technology known as electro-chemical activation (ECA).

RSCECAT USA, Inc. (the Russian Center for Electro-Chemical Activation Technique) is a technology transfer center established in Las Vegas. St. Louis-based Enviro-Chem Systems is a wholly-owned subsidiary of Monsanto Company.

This technology has the potential to revolutionize the usage of water as an oxidizing solution for both purification of water and as an environmentally friendly sterilizant. Carlos Iwaszkowiec, Business Manager of ECA Technologies for Enviro-Chem Systems explains that, "We are investigating ECA's ability to manipulate the physical/chemical properties of aqueous solutions to retard food spoilage, produce safer drinking water and enable a more sustainable use of water in industrial processes."

Vitold M. Bakhir, Ph.D. chairman and lead scientist of RSCECAT claims, "The relationship with Enviro-Chem Systems allows us to further develop the technology for new applications and enables broad exposure through Monsanto's worldwide marketing channels." Dr. Bakhir and several associates from RSCECAT USA will provide scientific and technical support to Enviro-Chem Systems.

Enviro-Chem Systems is investigating ECA Technology for specific applicability to food safety issues, including those raised by the recent announcement by President Clinton on the mandated inspection program for all federally inspected meat and poultry plants. According to George Rivers, meat industry consultant, "ECA solutions can have a direct impact on how the meat industry addresses pathogen reduction and the Hazard Analysis and Critical Control Points (HACCP) system."

"The license of the ECA technology is a result of Monsanto's ongoing search for and development of more sustainable technologies to raise the standard of living for our growing world population," says John E. McLean, leader of the New Products and Businesses Team, a key focus area for Monsanto's Sustainability initiative. "Water is an essential component of all natural and industrial systems. Because the technology can be delivered as small, modular, cost-effective systems, it is being used in Russia and elsewhere in a wide range of residential, agricultural, municipal, and industrial applications. For example, briefcase-sized units have been used in the Caspian Sea area to treat thousands of liters/day of pathogen contaminated drinking water."

Electro-chemical activation (ECA) has been used and researched for more than 10 years in Russia. RSCECAT, Monsanto R&D and Enviro-Chem Systems are cooperating in obtaining and reviewing the existing research and application data and will be seeking approval for use of this technology in the US and other countries. The technology enhances Enviro-Chem Systems environmental portfolio of air and water pollution control, SO_{ξ} technologies, and industrial cogeneration. For further information on ECA Technologies, contact Carlos Iwaszkowiec at 314-275-5742 or email at cci-

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Press release from RSCECAT:

RSCECAT, USA, INC.
340 East Warm Springs Road, Suite 1A
Las Vegas, Nevada 89119
Tel: 702-260-4100 Fax: 702-260-9044 E-Mail: drv@rscecat.com
Russian Scientific Center for Electro Chemical Activation Technique
Technology Transfer Center

RSCECAT, USA, INC. CORPORATE HISTORY

RSCECAT, USA, INC. ("RSCECAT"), an acronym for the Russian Center for Electro-Chemical Activation Technique, was incorporated in Nevada in August, 1995 to act as a technology transfer center for RSCECAT's revolutionary electro-chemical activation (ECA) technology. The ECA technology was developed by scientists Dr. Vitold M. Bakhir and Yuri G. Zadorozhny at the All-Russian Institute for Medical Engineering in Moscow and has been in widespread commercial use in Russia and the Commonwealth of Independent States (previously known collectively as the U.S.S.R), for a number of years, mainly in the areas of hospital disinfection, sterilization, food processing, and the agricultural and industrial sectors. There are over 60,000 ECA devices in use in Russia today. The first U.S. Patent for the technology was granted in June, 1995, additional patents are pending.

Dr. Bakhir is one of the preeminent scientists/inventors in Russia. He has been credited with the U.S. equivalent of over 400 Russian patents. (Until four years ago Russia did not have a patent system, instead inventors were awarded what are known as Certificates of Authorship.) Since the establishment of the Russian Patent Office, Dr. Bakhir has been awarded a number of additional patents.

The ECA technology represents a new scientific paradigm based on the process of transferring liquids into a metastable state with the help of electrochemical unipolar (anode or cathode) action through the instrument of an element/reactor, characterized by Bakhir and Zadorozhny as a "Flow-through Electrolytic Module" or "FEM." The FEM is capable of producing solutions, previously unknown in the scientific world, that have bacterial and sporicidal effects, yet are odorless and, due to neutral pH, gentle to human tissue, as well as being essentially non-corrosive for most machine surfaces. RSCECAT's FEM's have been incorporated by Bakhir and Zadorozhny into a variety of delivery systems (devices) used to produce solutions.

For assistance in introducing the ECA technology to the U.S. market, the Russians turned to Douglas Vineyard, a businessman and native of Las Vegas, who serves as RSCECAT's President and CEO. Mr. Vineyard and four Russian nationals including Dr. Bakhir and Yuri Zadoroshny were the founding shareholders of RSCECAT and presently constitute a majority of its board of directors. The company currently operates out of a suite of offices located on East Warm Springs Road in the vicinity of McCarran Airport.

With the aid of two Russian scientific advisors, Svetlana Panichiva, Head of the Laboratory for Electro-chemical Technique, and Vadim Panichev, chemical engineer, Doug Vineyard set out to determine whether or not there was a market for the ECA devices/solutions in the U. S. RSCECAT concentrated its marketing efforts on demonstrating its devices/solutions to potential licensees in a variety of industries. Funding for RSCECAT's patent estate & licensing program has been supported by local investors, mainly from the medical profession.

In April, 1996, while attending and exhibiting at a technology transfer symposium in Las Vegas, RSCECAT's team were approached by a representative from Enviro-Chem Systems, Inc., a subsidiary of the Monsanto Company, who expressed an interest in learning more about RSCECAT's ECA technology. Within a few weeks following its initial meeting with Monsanto, negotiations were undertaken during the course of which RSCECAT was represented by its corporate counsel, the 350 lawyer Washington, D.C. law firm, Shaw, Pittman, Potts & Trowbridge. These negotiations resulted in the signing of an exclusive worldwide license agreement in the areas of: (a) the treatment and disinfection of drinking water, waste water and agricultural or industrial process water and fluids, (b) agricultural or industrial air emission controls, and (c) treatment and disinfection in the food processing industries. Among the areas excluded from the Monsanto license were applications relating to the medical and healthcare industries.

The Monsanto license became effective in August, 1996. RSCECAT's ECA technology will be further developed by Monsanto to address the critical issues of food and water safety that are of increasing concern to an ever expanding world population.

Since the Monsanto license became effective, RSCECAT has turned its attention to developing medical and healthcare applications. Aided by a collection of professional consultants, the company is currently engaged in negotiations with a leading company providing sterilization and infection prevention products to the medical/healthcare industries. The U.S. military has engaged in contracts for testing ECA in several applications.

(See attached list of company officers and consultants).

RSCECAT, USA, INC.
LIST OF OFFICERS AND CONSULTANTS

DR. VITOLD BAKHIR
Chairman of the Board

DOUGLAS R. VINEYARD
President and CEO

JOHN HENRY BREBBIA
Executive Vice President and General Counsel
Former President of First Western Financial Corporation, Las Vegas, Nevada
Former Partner, Alston & Bird, Washington D.C. and Atlanta, Georgia

SVETLANA PANICHEVA
Secretary-Treasurer

DEE ANNE VAN STEENHUYSE
Accountant

E. GEORGE RIVERS
Meat Processing Consultant Former U. S. Meat Export Federation - Vice President, Pork Exports.
Retired Marine Lieutenant Colonel.

WESLEY L. FULTON
Chemical Engineer - Industrial Solutions Consultant
Former Utah Power & Light Technical Services Engineer

HARRY S. SILVERMAN
Business Consultant
Former Chairman of the Board, TASC, Inc., Boston, Massachusetts

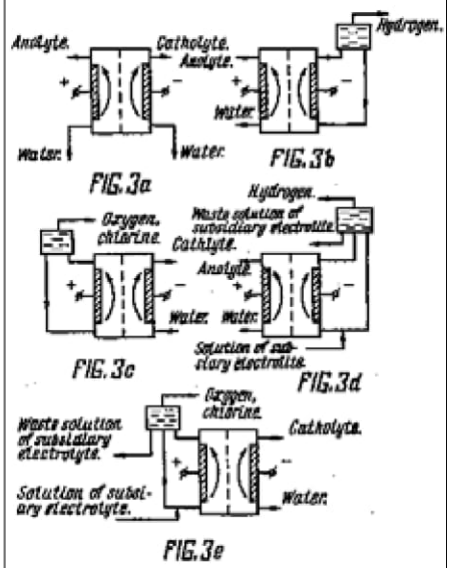
WILLIAM A. RUTALA
Medical Applications Consultant
Professor, Division of Infectious Diseases
Department of Medicine
University of North Carolina School of Medicine, Chapel Hill, North Carolina

GERALD H. TURLEY
Department of Defense Consultant
Former Deputy Assistant Secretary of Defense, Reserve Affairs

JOHN E. ROETHEL, ESQ.
Patent Attorney, Las Vegas, Nevada

RICHARD S. BEATTY, ESQ.
Corporate Counsel - Shaw, Pittman, Potts & Trowbridge, Washington D.C.

Fig. 3e - U.S. Patent 5,427,667



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Text of the Monsanto Enviro-Chem brochure

Following is the *text* from the Monsanto Enviro-Chem four-page flyer. The flyer is replete with diagrams of the process. Note well: it is *unthinkable* that Monsanto would be publishing this material if it had not fully validated this process. Large US corporations do not do that::

Who says electricity and water don't mix?

ENVIRO-CHEM SYSTEMS — Monsanto

Enviro-Chem uses electro-chemistry, common table salt and ordinary water in an innovative process that purifies water as well as creates solutions for sterilizing and disinfecting.

The revolutionary electro-chemical process licensed exclusively by Enviro-Chem creates an anolyte solution for sterilization and disinfection.

This process can also create a catholyte solution used to treat industrial waste or as a cleaning agent.

Enviro-Chem and its revolutionary ECA system are poised to dramatically improve the world of water treatment and purification.

The Critical Issue of Water Safety in the World:

Water is the essential element for life on earth. And sustaining that life requires clean, uncontaminated water. Yet today the water we need is increasingly subject to bacteria and other impurities.

The World Health Organization (WHO) reports that 50 percent of the worldwide infant mortality is caused by water-borne bacterial diseases. Moreover, the WHO estimates that 30,000 people die every day from drinking contaminated water.* (World Development Report 1993)

Food Safety Is An Area Of Rising Concern

Recent deaths in the United States and Japan attributed to the consumption of Escherichia cold (E. coli) contaminated food emphasize the importance of food safety as well.

Addressing Food and Water Safety

An ever expanding world population has put increased emphasis on the critical issues of food and water safety. Public health officials, microbiologists, engineers and epidemiologists are intensifying their efforts at finding solutions to these growing problems.

Monsanto is a leader in the development of more sustainable technologies that address these problems and raise the worldwide standard of living.

Electro-Chemical Activation for

Water Purification,Sterilization, Disinfecting

A revolution in water purification, disinfecting and sterilization has occurred in Russia with the innovative water technology known as Electro-Chemical Activation (ECA). Monsanto is working in close partnership with the inventors of this technology which has transformed the way water is treated and how disinfection and sterilization are handled in Russia and the Commonwealth of Independent States (CIS).

This scientific breakthrough uses classical principles of electro-chemistry and a new device called the Flow-Through Electrolytic Module (FEM) reactor, designed by Dr. Vitold Bakhir and Yuri G. Zadorozhny of the All-Russian Institute for Medical Engineering. The FEM is a cylindrical-shaped anode and cathode, constructed of titanium and rare metals, which are separated by a ceramic membrane.

In its most basic use, water contaminated with bacteria, fungi, etc. can be passed through the FEM unit to create sterile drinking water. Alternatively, the FEM reactor can produce two highly effective disinfecting and cleaning solutions using only tap water and table salt.

To create these safe and effective solutions, water, with natural or added salts, flows on both sides of the membrane (which permits electron transfer but prevents the flows from mixing) and is exposed to an electric field. The salts and minerals present in the solution undergo oxidation in the anode chamber and reduction in the cathode chamber. Two streams emerge from the FEM. These streams are called anolyte and catholyte in accordance with the electrode (anode or cathode) at which they were synthesized.

The Advantages of ECA

Water purification operations built with ECA systems using the FEM reactor are safe and efficient. The onsite generation of oxidants with ECA is a safe alternative, as it allows a user to eliminate the need to store and handle hazardous and toxic chemicals such as chlorine. The use of activated multiple oxidants in water purification in Russia has shown it to be more effective than chlorine alone. An ECA system with FEM reactors is also quite economical.A system with two FEM reactors generates about 60 liters of solution an hour to treat up to 20,000 liters of contaminated water. Salt requirements would be less than 400 grams and the power consumed would be about 150 watts. Using an ECA system reduces and eliminates costs for chemical additives, insurance for handling and transporting chemicals and the need for a highly qualified staff since only basic understanding is necessary to run the unit.

Water treatment with Electro-Chemical activation:

Sterilizing and Disinfecting With Anolyte

The anolyte stream contains oxidizing species which make it a powerful disinfectant that is extremely effective in the elimination of harmful organisms such as bacteria, viruses and spores. Russian research has shown that anolyte is much more effective as a disinfectant than commonly used disinfectants. And yet, these tests also show that anolyte is safe to human and animal life.

Due to its powerful bactericidal effect and low toxicity to humans, many hospitals in Russia and the CIS use anolyte in their sterilization procedures.

Sustainable Technology for Multiple Uses

The FEM is delivered as a small cost-effective system and being used in a wide variety of applications in Russia,

- **Municipal Water** -
To purify municipal and residential drinking water and household waste water. To disinfect swimming pool water.
- **Industrial** -
Cooling tower water treatment, paper bleaching process, laundry processing, galvanic and textile effluents treatment, and heavy metals removal process.
- **Agricultural** -
To purify animal drinking water and waste water. To produce crop field water. To produce disinfectants for veterinary applications. .
- **Food Processing** -
Eliminates harmful food-borne bacteria before storage or during processing and sanitizes plant equipment.

Catholyte Characteristics

The catholyte stream is a powerful alkaline solution that can be used to treat industrial waste material and to remove heavy metals by precipitation. Catholyte also has strong detergent qualities and can be used for washing purposes.

Catholyte is a safe and effective way to treat the waste from electroplating, photographic and textile plants. It can also be safely used for cleaning of food processing equipment prior to disinfection.

An Environmentally Sound Technology

The special design of the FEM is used to synthesize water containing very low concentrations of natural minerals and salts to generate a powerful mixed oxidant solution without requiring the use of concentrated chlorine. In addition, the disinfection byproducts are minimized.

The FEM also allows the user to dilute or increase the anolyte and catholyte streams in accordance with a particular need.

Because the FEM reactor uses and creates natural substances, it is a safe and environmentally sound method for water treatment.

Quality Water for Today and Tomorrow

The ECA technology with the FEM reactor is a dramatic step forward in providing safe food and water in a sustainable fashion. Completely safe and effective, the FEM truly is a revolutionary advance in water treatment.

Enviro-Chem, a sustainable Way of Doing Business

Enviro-Chem Systems, Inc. designs environmental systems to meet the needs of clients throughout the world. To help our clients improve business results, Enviro-Chem is committed to a vision of a sustainable environment and dedicated to a total quality approach in all its projects.

In accordance with this vision, Enviro-Chem is pioneering efficient and economical ways to manage waste, energy and raw materials; to purify the air and water, to protect the environment, and to do so in an ecologically sustainable way.

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See our home page at: http://www..enviro-chem.com e:mail enviroch@monsanto.com

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Brussels, Belgium 32-2-776-4111
Manila, Philippines 63-2-818-3966
Moscow, Russia 7-095-0001
Sao Paulo, Brazil 55-11-817-6102
Seoul, Korea 82-2-736-2681
Shanghai, China 86-21-6-279-8669
Singapore 65-250-2000
Taipei, Taiwan 886-2-738-7867

ABSTRACT of US Patent 5,427,667
"Apparatus for Electrochemical Treatment of Water"

An apparatus for electrical treatment of water can be used for purifying and disinfecting potable water, and also for producing detergent and disinfecting solutions, and comprises at least one electrochemical cell made up of an upright cylindrical electrode and a rod electrode of a variable cross-section mounted coaxially in dielectric sleeves, an ultrafiltration diaphragm made from ceramics based on zirconium oxide and coaxially mounted in the sleeves between the electrodes, the geometrical dimensions of the cell meet some definite relationships. The system of openings in the electrodes and ducts in the sleeves provides for the optimal hydraulic characteristics of the cell. The sleeves and cylindrical electrode have the same external diameter and the cells are specially secured by means of gaskets in the upper and lower headers of a dielectric material with cylindrical sockets in each and supply and discharge ducts. The headers have several sockets each or are made as a built-up structure composed of units having one socket each, and are provided with means for sealing and bracing the structure, and the cells accommodated in the sockets are hydraulically connected in parallel and electrically connected in parallel and series-parallel. The apparatus can also comprise flow rate control devices adapted to meter a reagent and mounted at the water supply line, containers with a catalyst and a hydraulic connection. The apparatus permits of reducing the electric power consumption, simplifying the design, reducing labor expenditures in assembly and disassembly of the apparatus, and also makes it possible to widen the functional potentialities due to simplifying and unifying the hydraulic system of the apparatus.

10 Claims, 5 Drawing Sheets

New Energy Times Archive

Received from our USPTO "Mole"—Tom Valone, who gave us permission to publish this.....

NOTICE: JOB OPPORTUNITY

U.S. Patent & Trademark Office Hiring 600!

All able-bodied Infinite Energy technologists are invited to infiltrate the U.S. PTO immediately. Due-to the expansion into Industrial Sectors, the Patent Office needs to hire at least 600 engineers, physicists, and computer scientists in the next few months (possibly other disciplines also) as Patent Examiners. The Office has a new motto: "Help Our Customers Get Patents." All training and moving expenses are covered. Even the starting salary has been increased to attract all of the new employees needed: GS 7, Step 10 = $39,700 for the first year with step increases each year and grade advances based upon performance. In addition, a bonus of 10% ($3970) is being paid to any Electrical/Electronic Engineer (EE degree) Computer Scientist (CS degree) hired!

Being at the Patent Office as an insider for almost two years I, Tom Valone, invite those who believe in the philosophy expounded by Tesla, Moray, etc. to join me. Together we can make policy changes happen slowly within the system. Our goal is to help obtain patent protection for new emerging technology that may be regarded as "inoperable" by those without your background. Only a bachelor's degree is needed! In addition, our goal is to research existing records of energy and propulsion technology which have been sitting unrecognized in the stacks and abandoned cases. (As an insider, you will have the privilege to examine any present or past patent application, such as Newman's, Moray's, Puharich's, etc., within security limits, even if it is an abandoned case.)

Furthermore, you will have at your desk, the most advanced search software available which allows an examiner to use ANY key word or phrase to find lists of patents and look at their images instantly. The Patent Library is as well-stocked as most university libraries and journal-search, services (Dialog, etc) are available. You are also allowed to compile collections of your favorite patents as you learn. The actual examining that you do is not under any quota for the first year! All training in patent procedure is during work hours, at the Patent Academy, and most examiners receive their own private office. Also, two Fitness Centers are available, one of which has a swimming pool.

Lastly, if you speak English as your first language, you will have a hiring advantage over many applicants. (All patent applications are in English of course.) However, many have been hired who do not have a great command of English since the Patent Office needs examiners. You may send your application to the Human Resources Dept. at the Patent and Trademark Office, Washington, DC 20231 or you may call them at 703-305-8231. Also, if you like, many insiders like myself are able to hand-carry resumes to our supervisors. Therefore, I will also accept resumes sent to Integrity Research Institute, 1422 K Street NW, Suite 204, Washington, DC 20005 and pass them on to my PTO supervisor or the appropriate PTO art unit supervisor if possible. Retirement, health insurance, and a government assisted thrift savings plan are some of the benefits.

MIT-Based Cold Fusion Movie "Breaking Symmetry" to be Released in 1998

The "Bastion of Skepticism" against cold fusion—MIT—is in for a rude and much-deserved shock later this year. The techno-thriller movie with cold fusion and cosmic dark matter as a theme, "Breaking Symmetry," should be released sometime later in 1998. The movie is frank and graphic, with very thinly disguised references to real events that occurred when MIT hot fusioneers, and former Chemistry Dept. head Prof. Mark Wrighton performed a hatchet-job against cold fusion in 1989.

Professor Keith Johnson
MIT News Office Photo: Donna Coveney

The movie script was written by former MIT Professor Keith Johnson, who raised substantial funds to produce and direct the movie himself. *The Institute* (MIT) is a backdrop to the drama in which a young female professor encounters ridicule and obstruction by hot fusion people in her efforts to link a theory of excess energy in electrochemical cells to cosmic dark matter. Johnson's Cambridge-based feature film production company, Archimage, has other films in the works.

Professor Johnson told *Infinite Energy* that he intends to enter *Breaking Symmetry* in one or more film festivals in the US and Europe this year. Though he could not provide an exact month for the movie's wider release in theaters in the US—negotiations with distribution companies are underway, he expressed confidence that 1998 would the the year the public sees his labor-of-love.

In advance of filming *Breaking Symmetry*, Prof. Johnson gave the movie script to the MIT News Office as a preliminary to requesting permission to use MIT facilities in the production. There was no formal response to this request from either the News Office or the MIT Administration. So, Johnson proceeded to film his movie anyway—on public land in front of MIT. Much of the action takes place in Cambridge.

The multi-talented Professor Johnson was formerly a full-professor in MIT's Dept. of Materials Science and Engineering. He retired from MIT to pursue not only his movie-making activities, but also to work within Quantum Energy Technology, Inc., a Cambridge, Massachusetts company that is working on advanced energy technologies connected with—you guessed it!— anomalous energy from water. In April 1989, shortly after Drs. Fleischmann and Pons made their fateful announcement, Professor Johnson (and separately, now beleaguered MIT Professor Peter L. Hagelstein of the Electrical Engineering and Computer Science. Dept.) were among the first to publicly propose theories to explain cold fusion.

Dr. Johnson's technology company,

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QET, is also is engaged, more prosaically, in research to improve the efficiency of gasoline combustion. Another founder of QET is Mr. John Preston, formerly head of the MIT Technology Licensing Office.

Ironically, the technology licensing office at the University of Utah was in recent months trying to find a home for the embattled Pons and Fleischmann cold fusion patent applications (see *IE* Issue #12). For a brief time, QET may have considered acquiring the rights to the P&F patent application, but now those applications appear finally dead—thanks to the documented egregious misbehavior of examiners at the USPTO.

Fleischmann-Pons Patent Applications Appear Finally Dead in the U.S.

We knew this would happen soon enough, a matter to give cheer (albeit temporary) to the enemies of cold fusion, but the sad news has now emerged from the University of Utah. From the *Salt Lake Tribune*, Tuesday March 10, 1998:

"U. Officially Ends Its Effort to Capitalize on Cold Fusion

"Almost nine years after two University of Utah scientists first claimed to produce nuclear energy in a test tube, the U. has officially abandoned its effort to capitalize on cold fusion.

"U. Research Vice President Richard Koehn announced Monday that the U.'s Research Foundation will no longer pursue patents based on the experiments of former U. chemists B. Stanley Pons and Martin Fleischmann.

"At a March 23, 1989 news conference, the pair claimed that their simple, tabletop device was producing such incredible amounts of heat that it could only be explained by nuclear reactions. That triggered a worldwide scramble to reproduce the experiment.

"But in the end — when the claims could not be proved — the scientists and the U. found the real heat came from the scorching they received via the scientific establishment.

"Pons and Fleischmann left the U. within two years, and the university eventually transferred the patent rights to a private company, ENECO. The U. was forced to look for another licensee when ENECO gave back the rights, but no viable offers surfaced. Pons and Fleischmann had the option to take up the fight themselves, but the U. never heard from them, Koehn said."

In summary for history: The reason these pioneering patents were *not* approved at the USPTO is a direct result of the *criminally* negligent "investigation" of cold fusion by a biased US Dept. of Energy ERAB Cold Fusion Panel and the follow-through by USPTO officials acting unethically and illegally in their citation of: fraudulently presented data from the rush-to-judgement MIT experiments and incompetently analyzed data from Caltech, Harwell Laboratory, and elsewhere—all purporting to disprove excess energy production in heavy water Pd/Pt cells.

Dr. Kevin L. Wolf, Cold Fusion Pioneer, and Later Turncoat — Dead at 55

One of the big names in cold fusion in the early days (1989 and 1990), nuclear chemist Dr. Kevin L. Wolf of the Cyclotron Institute at Texas A&M University, has died. Dr. Wolf observed tritium and neutrons, then spoke of them in the DOE-sponsored cold fusion conference in May 1989; he published his results.

The obituary from the *Bryan-College Station Eagle* newspaper:

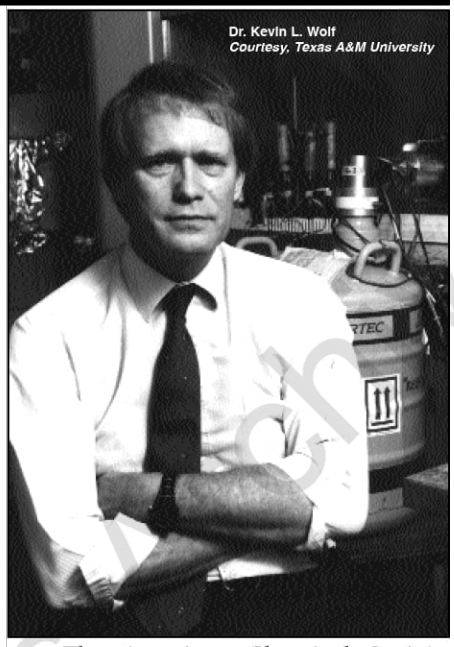
Kevin Leroy Wolf
March 29, 1942 — Sept. 11, 1997

A memorial service for Kevin Leroy Wolf, 55, of College Station is set for 2 p.m. Monday at Southwood Funeral Home. Dr. Robert Leslie of First Presbyterian Church will officiate. Visitation is from 4 to 6 p.m. this Sunday at the funeral home. Mr. Wolf died Thursday afternoon at home.

He was born in Logansport, Indiana.and lived in College Station for 15 years. He was a chemistry professor at Texas A&M University and conducted research in nuclear physics at the Cyclotron Institute at A&M.

Survivors include his wife, Barbara Wolf of College Station, and a daughter, Jennifer Wolf of College Station.

Memorials may be made to the children's section of the new College Station Library.


Dr. Kevin L. Wolf
Courtesy, Texas A&M University

The American Chemical Society Division of Nuclear Chemistry and Technology newsletter (Fall, 1997) mentions a symposium in his memory that is to be held March 30, 1998 in Dallas, TX.

The very tragic role that Dr. Wolf was to play involved the uncalled-for renouncing of his tritium measurements (during the Gary Taubes "Inquisition" of 1990). His doubts about alleged "pre-existing contamination" of tritium in palladium samples were fully addressed by the team of Dr. Fritz Will and others who published a meticulous study showing that contamination could not have occurred.

Wolf was subsequently *paid* by an enemy of cold fusion within EPRI, Dr. Tom Schneider, to *disprove* cold fusion! Well, Wolf accomplished nothing of the kind: he immediately found elevated neutron counts in his Fleischmann-Pons experiments -- in 1992. He also produced some of the "hottest" (in a radiation sense) Pd rods in the history of cold fusion. The rods had numerous transmutations apparent within them that were confirmed by gamma ray analysis – see Issue #2 of *Infinite Energy* ("Alchemy Nightmare: Skeptic Finds Heavy Element Transmutations in Cold Fusion Experiment!", pp.30-32). Wolf was set to give a keynote talk about these at ICCF4 in Maui, Hawaii in 1993, but Schneider dissuaded him and he never showed up.

He was going to present the data of which he was *totally convinced*. However, he did not think that the Pd rods had become radioactive due to "cold fusion," but rather due to some kind of cosmic WIMP particles that just happened to be

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passing by while he was doing his cold fusion experiments!! Talk about trashing the principle of Occam's Razor — no better example could be found.

Poor Dr. Wolf, who did not discourage hatchet job science journalist Gary Taubes (*Bad Science*, 1993) and who, by keeping his silence helped the Texas A&M inquisition against Bockris later in the 1990, has died with much good work to his name in cold fusion. But as good a person as he might have been, and we are very sorry to learn of his death, Wolf's epitaph is that of a man who was not in this instance faithful to the cause of scientific truth—at least the truth regarding cold fusion phenomena.

Russian Physics

Conference for Heretics June 1998

•RUSSIAN ACADEMY OF SCIENCES
•RUSSIAN GEOGRAPHIC SOCIETY
•PETROVSKY ACADEMY OF SCIENCES AND ARTS
•ST. PETERSBURG PHYSICAL SOCIETY
• ST. PETERSBURG OFFICE OF "EXICO AB" COMPANY, SWEDEN
• SCIENTIFIC RESEARCH INSTITUTE OF RADIO AND ELECTRONICS

PRELIMINARY ANNOUNCEMENT

Dear Sirs,

We have the honor to invite you to take part in the International Scientific Congress "Fundamental Problems of Natural Sciences," which will take place in June 22-27, 1998 in St. Petersburg, Russia. The Organizers suggest the following problems for discussion at the 1998 Congress:

1. Substance, Electromagnetism, Gravitation
2. Elements, structure and interaction of Earth and Universe systems
3. Mechanics
4. Nontraditional Sources of Energy and Technologies

The new research into physics and other spheres of Natural Sciences will be presented at the 1998 Congress. It is proposed that at the final session of the 1998 Congress, there will be a discussion of earlier work from the international conferences: "New Ideas in Natural Science," June, 1996 and "Space, Time, Gravitation," September, 1996. If you agree to take part in the 1998 Congress, the organizers ask you to fill out the Registration Form enclosed and send it together with the Abstract of your paper (no more than 1/2 page) to the Local Organizing Committee (LOC) before December, 1997.

The Organizing Committees of the two previous international conferences ("New Ideas in Natural Science," June 1996 and "Space, Time, Gravitation," September, 1996) have joined. The chairman of the united LOC is Michael Varin, the Vice-Chairman is Marina Karpoukhina and Anatoly Smirnov.

Address of the LOC:
Office: Dr. M. Varin
Postal Box N 3
193036 St. Petersburg
Russia
Home: Dr. M. Varin
65-9-1 Pulkovskoye Rd.
196140 St. Petersburg
Russia

Contacts:
Fax: (7) (812) 277-12-56
Phone: Tatyana Doganonskaya, Secretary
Office: (7) (812) 277-00-37
E-mail: exico@mail.nevalink.ru

Home: (7) (812) 224-89-76
(please, call after 8:00 p.m. local time)

Conference Held Honoring

MIT Professor Parry Moon Who Challenged Einstein's Special Theory of Relativity

A group of scientists, mathematicians, and engineers who question the theoretical and experimental foundations of much of modern physics, especially Einstein's Special Theory of Relativity, met in Philadelphia in February. *Infinite Energy* later this year will publish a full report on this mind-expanding conference and on the group, the *Natural Philosophy Alliance*, which organized it. For now, here is the descriptive meeting announcement:

"THE SEARCH FOR REALITY: TOWARDS OBJECTIVITY AND RATIONALITY IN PHYSICS"

— a Conference in Honor of the late Prof. Parry Moon of M.I.T.
on the 100th Anniversary of his Birth,
Saturday, February 14, 1998
Blauvelt Theater, at Friends Select School, downtown Philadelphia
17th Street and Benjamin Franklin Parkway, northeast corner
from 8:00 a.m. to 11:20 a.m, and from 12:30 p.m. to 6:15 p.m.

Prof. Parry Moon (1898-1988) was for several decades one of the most brilliant and prolific critics of 20th-century electrodynamic theory, developing alternative ideas in the authoritative tradition of K. F. Gauss and Wilhelm Weber. This centennial conference will continue in his spirit of constructive criticism, giving particular attention to the many flaws in, and proposed replacements for, Einstein's special relativity theory.

Speakers, in order of presentation:

Prof. Domina Eberle Spencer (Mathematics, Univ. of Connecticut; wife and longtime scientific collaborator of Parry Moon; and Vice-President, *Natural Philosophy Alliance*);
Dr. Tom Van Flandern (Meta Research; Physics, Univ. of Maryland);
Francisco J. Muller (Miami, Florida; President, *Natural Philosophy Alliance*);
Dr. Delbert J. Larson (Integrated Accelerator Technologies, DeSoto, Texas);
Dr. John E. Chappell, Jr. (San Luis Obispo, Calif; Director and Secretary, *Natural Philosophy Alliance*);
S. Richard Hazelett (Colchester, Vermont; Co-Editor, *The Einstein Myth and the Ives Papers*)
...[Lunch]...;
Dr. John Chappell;
Dr. Cynthia K. Whitney, (Electro-Optics Technology Center, Tufts Univ.; Editor, *Galilean Electrodynamics*);
Francisco J. Muller;
Dr. Uma Y. Shama (Mathematics, Bridgewater State Col., Mass.);
Curtis E. Renshaw (Tele-Consultants, Alpharetta, Georgia);
Robert S. Fritzius (Shade Tree Physics, Starkville, Miss.);
Prof. Domina Eberele Spencer;
Prof. Mahmoud A. Meleby (Electrical and Systems Engineering, Univ. of Connecticut).

Presented by:
THE NATURAL PHILOSOPHY ALLIANCE,
P. O. Box 14014, San Luis Obispo, California 93406.

This is the world's largest organization — with members in 21 countries — devoted to criticizing unsound concepts in modern physics and to developing realistic alternatives. The NPA and others have held many similar meetings, mostly in Europe, since the 1980s. These meeting are necessitated by decades of refusal to allow such fundamental criticism in establishment meetings and journals.

Co-sponsored by THE CENTER FOR FRONTIER SCIENCES at Temple University., Philadelphia. This conference will occur during the 150th anniver-

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sary meeting of the American Association for the Advancement of Science (Feb. 12-17), and only about five blocks west of it.

Distinguished

Professor of Chemistry, John O'M. Bockris

(Texas A&M University, retired)

Wins "Ig Nobel" Prize for Cold Fusion

The scientific establishment, with a "center of gravity" (or levity!) that appears to be Cambridge, Massachusetts, entertains itself annually at the "Ig Nobel Prize" Ceremony. It pokes fun at things that it often does not understand, and especially *does not like*, with its "awards" for what it deems to be foolish or wrong-minded research. You can find out all you want to know (or would perhaps care NOT to know) about this ceremony at:

http://www.eecs.harvard.edu/ig_nobel/

The 1997 Ig Nobel Prize Ceremony decided to mock electrochemistry Professor John O'M. Bockris, who has been a towering figure in cold fusion and low-energy nuclear reactions research.

Here, in part, is how the Ig Nobel organization described the 1997 event:

"A new crop of Ig Nobel Prizewinners was honored at the Seventh First Annual Ig Nobel Prize Ceremony, held before a paper-airplane-throwing sellout crowd of 1,200 in Harvard University's Sanders Theatre on October 9, 1997. A good-natured spoof of science and the Nobel Prizes, the ceremony honors people whose achievements "cannot or should not be reproduced."

"This year's Ig's was seen by more people than ever before due to our live internet broadcast. The event was also recorded, and will be rebroadcast on National Public Radio.

"The event was presented by The Annals of Improbable Research (which has been described as "the MAD Magazine of science"). It was co-sponsored by the Harvard-Radcliffe Science Fiction Association, the Harvard Computer Society, and the new book "The Best of Annals of Improbable Research."

The Winners:

BIOLOGY:
T. Yagyu and his colleagues from the University Hospital of Zurich, Switzerland, from Kansai Medical University in Osaka, Japan, and from Neuroscience Technology Research in Prague, Czech Republic, for measuring people's brainwave patterns while they chewed different flavors of gum. [Published as "Chewing gum flavor affects measures of global complexity of multichannel EEG," T. Yagyu, et al., "Neuropsychobiology," vol. 35, 1997, pp. 46-50.]

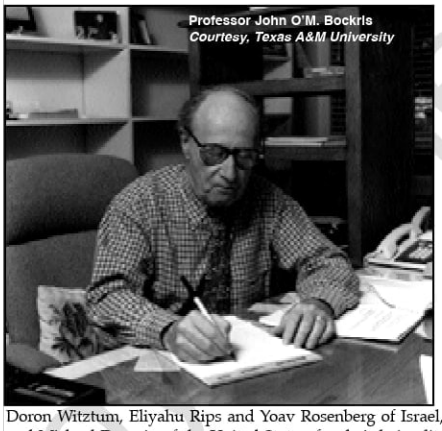
ENTOMOLOGY:
Mark Hostetler of the University of Florida, for his scholarly book, "That Gunk on Your Car," which identifies the insect splats that appear on automobile window. [The book is published by Ten Speed Press.]

ASTRONOMY:
Richard Hoagland of New Jersey, for identifying artificial features on the moon and on Mars, including a human face on Mars and ten-mile high buildings on the far side of the moon. [For details, see "The Monuments of Mars: A City on the Edge of Forever," by Richard C. Hoagland, North Atlantic Books, Berkeley, CA,1996.]

COMMUNICATIONS:
Sanford Wallace, president of Cyber Promotions of Philadelphia — neither rain nor sleet nor dark of night have stayed this self-appointed courier from delivering electronic junk mail to all the world. Those wishing to send congratulatory notes can address them to: Cyber Promotions, 1255 Passmore St. Philadelphia, PA 19111 USA.

PHYSICS:
John Bockris of Texas A&M University, for his wide-ranging achievements in cold fusion, in the transmutation of base elements into gold, and in the electrochemical incineration of domestic rubbish.

LITERATURE:


Professor John O'M. Bockris
Courtesy, Texas A&M University

Doron Witztum, Eliyahu Rips and Yoav Rosenberg of Israel, and Michael Drosnin of the United States, for their hairsplitting statistical discovery that the bible contains a secret, hidden code. [Witztum, Rips and Rosenberg's original research was published as Equidistant Letter Sequences in the Book of Genesis," *Statistical Science*, Vol. 9, No. 3, 1994, pp. 429- 38. Drosnin's popular book, "The Bible Code," was published by Simon & Schuster.]

MEDICINE:
Carl J. Charnetski and Francis X. Brennan, Jr. of Wilkes University, and James F. Harrison of Muzak Ltd. in Seattle, Washington, for their discovery that listening to elevator Muzak stimulates immunoglobulin A (IgA) production, and thus may help prevent the common cold.

ECONOMICS:
Akihiro Yokoi of Wiz Company in Chiba, Japan and Aki Maita of Bandai Company in Tokyo, the father and mother of Tamagotchi, for diverting millions of person-hours of work into the husbandry of virtual pets.

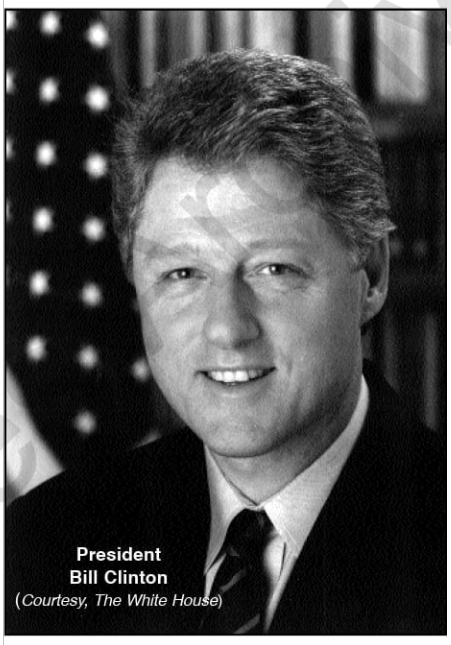
PEACE:
Harold Hillman of the University of Surrey, England for his lovingly rendered and ultimately peaceful report "The Possible Pain Experienced During Execution by Different Methods." [Published in "Perception 1993," vol 22, pp. 745-53.]

METEOROLOGY:
Bernard Vonnegut of the State University of Albany, for his revealing report, "Chicken Plucking as Measure of Tornado Wind Speed." [Published in "Weatherwise," October 1975, p. 217.]

"I have not the smallest molecule of faith in aerial navigation other than ballooning...I would not care to be a member of the Aeronautical Society."
—Lord Kelvin, 1896

Presidential Candidate Bill Clinton Knew of "HeavyWatergate" Scandal in 1992 and did Nothing to Investigate...

by Eugene Mallove


President
Bill Clinton
(*Courtesy, The White House*)

President Bill Clinton knew about the "HeavyWatergate" scandal against cold fusion before 1992, years before he became the Democratic Party's presidential nominee. I know. I taped his admission in Concord, New Hampshire January 12, 1992.

He knew that U.S. Department of Energy officials had, ***as he put it,*** "stonewalled" several scientists in Arkansas, who were trying to do critical research on cold fusion.

The US Dept. of Energy (DOE) sponsored "investigation" of cold fusion for only a few months in 1989 can now be seen as a fraudulent rush-to-judgment by a panel of so-called "experts." Many on this panel are on record as having been convinced, even *before* the investigation began, that the Pons and Fleischmann claim was total nonsense. One of them, Dr. William Happer, then a senior DOE official, recalls in a book: "Just by looking at Pons and Fleischmann on television you could tell they were incompetent boobs." So much for his claim to be a dispassionate advisor to the US Secretary of Energy under President Bush!

The DOE got the answer it expected and the multi-billion dollar dead-end hot fusion program continues to waste bil-

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lions of dollars and relegate the cold fusion discovery to snickers and confusion among the bulk of the not very perceptive science journalists.

HeavyWatergate — as it has become known by a large group of beleaguered researchers and developers in the United States — was concocted by a handful of special government interest academics and Federal bureaucrats who improperly advised two U.S. Presidents, including Bill Clinton. This was a matter of overarching importance: the energy independence of the United States and the environmental salvation of the world. But greed and academic arrogance won out —at least for the past nine years.

Yes, scientists in 1992 presidential candidate Bill Clinton's own state of Arkansas were victims of this fraud after 1989. Clinton did not know how the fraud came about, but he certainly knew about "HeavyWatergate" in general terms, yet he has done *nothing* since he became President to clean it up. To be fair to the President, biased and misinformed science advisors have his ear—the fault is not his alone. But with a flick of a pen or a single phone call, President Clinton could authorize a full-scale investigation of this important matter. Don't hold your breath.

In January 1992, Bill Clinton was beginning to ride high in the presidential polls. HeavyWatergate was already three years old. Unlike other allegations made against the future President, there was absolutely no doubt about what Clinton knew and when he knew it in the matter of this HeavyWatergate scandal [See below the transcript of our January 12, 1992 interchange in Concord, New Hampshire].

Clinton promised to investigate the issues I publicly brought to his attention in an open forum in Concord. Clinton, Gore, and their staffs receive *Infinite Energy* magazine *gratis*, yet this Administration — like the Bush Administration before it — has only exacerbated the scandal of neglect. The perpetrators of HeavyWatergate go unpunished. Nay, they are being rewarded by generous increases in Federal R&D grants in the proposed new Clinton-Gore budget.

HeavyWatergate is the story of how the U.S. Government and gullible journalists were bamboozled into thinking that a liberating scientific discovery was itself fraudulent. Cries of "fraud" became fraud. This may well be the greatest example of government perfidy and incompetence in the history of the Republic. To realize its significance is to know that its importance dwarfs questions about what Bill Clinton did or did not do with Ms. Monica Lewinsky or anyone else. For this is a scandal that has already affected and will affect the lives and destiny of billions of people.

As we were recently preparing to go to war with Iraq, I reflected on the meaning of HeavyWatergate to our entire foreign policy. The U.S. Government — the Department of Energy, Bill Clinton, Al Gore, and George Bush before them — have neglected one of the most important scientific and technological discoveries of the millennium. We in the cold fusion field have tried to get our case through to this President and to many other politicians. With rare exceptions, the message has not been listened to. In one instance (in the early 1990s), Vice President Gore deliberately *refused* to receive a briefing by qualified scientists, after being urged to do so by a friend at a major US computer corporation. So much for the open-mindedness of Mr. Gore.

Special interests within government have overwhelming power to keep this issue temporarily suppressed and retarded. They will not succeed in delaying the introduction of the new energy indefinitely, but they have delayed it far beyond what I would have suspected in 1991 when I left my position at MIT, one of the most culpable of the academic institutions involved in HeavyWatergate.

Blinded as he is, the President of the United States cannot advise the oil cartel here and abroad that its time is limited and that we must prepare for a technological upheaval that will dwarf the personal computer revolution. The entire energy infrastructure will soon have to be retrofit.

If Clinton or whoever follows him did reverse course and do something about HeavyWatergate, they could confidently tell the Kuwaitis, the Saudis, and Saddam Hussein himself, that in the next few years oil, coal, natural gas, and conventional fission nuclear power will begin to be as obsolete as manure from horse-drawn carriages. With or without official support — because cold fusion is pre-eminently a matter that can be handled in the private sector (*Especially without government interference such as has already occurred!*) — the shock to the oil barons and others will be massive and well-deserved.

The following exchange between Eugene Mallove and then Governor Bill Clinton of Arkansas occurred at Temple Beth Jacob in Concord, New Hampshire, Sunday, January 12, 1992

Eugene Mallove (EM) asks presidential candidate Gov. Bill Clinton a question at a public forum:

EM: Governor, I'm an engineer and an author and the things I have to ask you about are probably too complicated for a short question, but I do want to get your reaction, OK? And it actually might involve — does involve— the very important question of energy, which I think you will probably agree is one of the most critical matters in this country.

I want to know how you would react *before* you're elected and I want to know how you would react and what you would do *after* you're elected, because there is a *scandal* in the United States going on right now in energy policy. You probably know that the United States spends—you don't know *this* scandal, but I'm going to hand it to you on a silver platter and that's fine, because I'm impressed with what I've seen so far, by the way, and I encourage all you good Democrats out there—I'm a registered Republican!

[Audience laughter]

Hold on friends! I'm impressed with what I've seen so far and I have *no* allegiances. I want to know how you would react, because George Bush and others have not reacted in this way. We spend 500 million dollars a year on a hot fusion program that requires 150 million dollars spent on what amounts to a weapons project—inertial confinement fusion. And the other one is "good"—it's magnetic confinement fusion. However, in 1989 —and don't laugh friends— Stan Pons and Martin Fleischmann announced in Utah with great fanfare what they thought was cold fusion. Guess what? There are something like—and here's the petition which Congressman Swett has accepted from us—over 200 scientists, including Nobel laureate Schwinger, and Japanese scientists can you believe—talk about a competitiveness issue!

The problem is this: The Federal Government is spending *zero* on this. We've asked for hearings. Congressman Swett has paved the way. What I want to know is would you not tolerate in your energy advisor the kind of language that has come from Secretary Watkins. In January 1990 he said this:, "I think it is very premature at this time to say we are losing a race in cold fusion when we have very clearly validated that we are not sure that it is fusion." Would you fire such a person, would you investigate this problem, would you take some action? And above all would you realize that next week the head of the Japanese fusion program (I have a fax, I can hand it to you) is about to go to MITI —and he says to us that the Japanese government is supporting cold fusion. All right, what will you do *now* and what will you do *after* —period? Thank you!

Governor Clinton: He was right about the *complicated* part!

[Audience laughter]

Let me say that just by blind coincidence—there are people in my state who have tried to work on fusion technologies—non-nuclear fusion technologies—that is what he's talking about. Basically to generate more energy than you'd use.

EM: Yes.

Governor Clinton: That's the idea. There is such a skepticism about it because most people refuse to believe that any kind of fusion technology—again, I'm saying we're talking about non-nuclear now—could ever be devised to generate more energy than you use in the process. We have worked on it at home. We have tried to use some of our oil overcharge money to do it and we have met a similar stonewall. Without in anyway...my guess Admiral Watkins signed a letter that someone else drafted for him...

EM: That's correct.

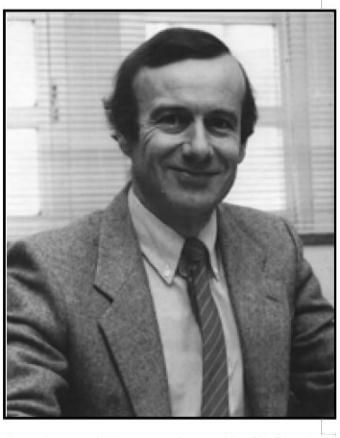
Governor Clinton: And to be fair to Admiral Watkins, he did have a better energy policy than this Administration let him pursue. But I believe we should actively explore the possibilities of fusion research and development. I think it is something we cannot afford not to... In the Middle East it undermines the integrity of our political decisions in that area. It's cheap oil if we have to drill in fragile areas off shore in the Arctic National Refuge — and it undermines our environmental policies. It's just cheap oil. Our energy policy needs to go to the following alternatives: 1. In the interim, use more natural gas because comparatively it's cheap, plentiful, and clean; 2. Dramatically increase research and development into alternative forms of energy, including fusion; and 3. Achieve European levels of energy efficiency in every factory and office building in America. One reason the average German factory worker makes 20% more than his or her American counterpart is that they produce the same industrial output for one-half the energy.

So, I will pursue an aggressive energy policy. I should have listed that in my opening with economics, education and health care. *I will look into the fusion issue.*

Let me say, as far as becoming a Republican, if I might make one religious comment since it's Sunday and its my worship day. I'm a Baptist and we believe in death bed conversions .[Audience laughter]

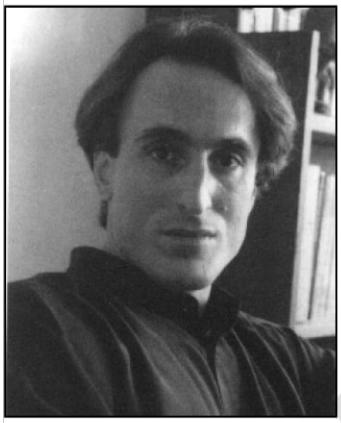
Words to Eat....

Δρ. θοην Ρ. Ηυιζενγα, Co-chairman, U.S. DoE Cold Fusion Panel: "**Believers in cold fusion, like, for example, Eugene Mallove, are unwilling to accept the negative experimental evidence on cold fusion and look for all kinds of other unrelated reasons to explain why the subject is slowly dying." ...."The proliferation of so-called 'theories' was one of the greatest surprises in the entire cold fusion episode." "...It is seldom, if ever, true that it is advantageous in science to move into a new discipline without a thorough foundation in the basics of that field.""...On rare occasions self-taught outsiders make a discovery in an area largely unknown to them, but this is indeed rare." ..."As a field matures, as nuclear physics has over the last century, the probability of a surprise becomes ever so much less probable."**[*Cold Fusion: Scientific Fiasco of the Century*, University of Rochester Press, 1992.]



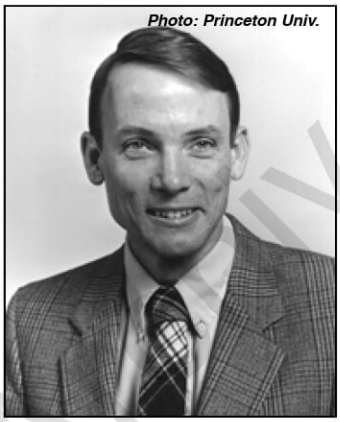
Δρ. Φρανκ Χλοσε, Theoretical Physics, Rutherford Appleton Laboratory, Chilton, UK, author of *Too Hot to Handle*, 1991 (anti-cold fusion book alleging that Drs. Fleischmann and Pons were *both* wrong and unethical): **"Do we regard this [cold fusion] fiasco with detached resignation, or express more strongly our dissatisfaction with the deceptions, exaggerations, and ethically disoriented presentations that stimulate vast diversion of international resources?...If science does not ensure that its house is in order, who will?"** [*American Scientist*, January-February 1993.] (Above—*Jacket photo from Too Hot to Handle: The Race for Cold Fusion*)

(*Right, above: Jacket photo of Gary Taubes by Aimee Nestinger, from Bad Science*)

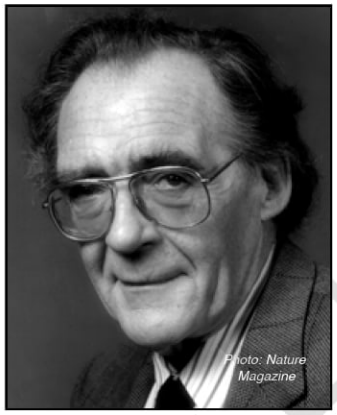


Γαρψ Ταυβεσ, science journalist, **"In a fast-paced news-breaking account that reads like a novel, noted science journalist Gary Taubes brings to life one of the greatest scientific frauds of our times."** [From the promotional flyer, the very first page of the reviewer's "uncorrected proof" copy of Gary Taubes' *Bad Science: The Short Life and Weird Times of Cold Fusion*, 1993]

"**The cold fusion episode teaches two lessons that can be applied as meaningfully to journalism as to science: 1. Do your research, because nothing is as simple as it seems. 2. Make sure you've got the story right before you publish."** [*Bad Science*, 1993] It is too bad that Taubes had not absorbed his own advice! He later was admitted to the Knight science journalism program at MIT!



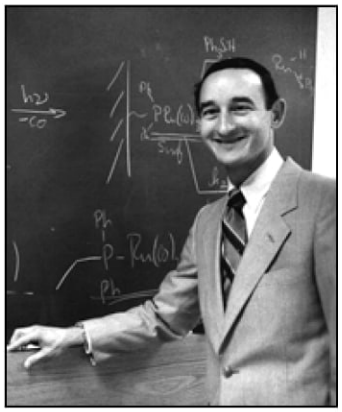
Δρ. Ωιλλια μ Ηαππερ, US DoE official with Princeton hot fusion background, on the 1989 DoE "unbiased" cold fusion panel. **"...just by looking at these guys [Pons and Fleischmann] on television, it was obvious they were incompetent boobs."** [in *Bad Science*, 1993, by G. Taubes] **"On weekends industries close down, and it's common for line voltage to rise a little bit. Huggins didn't know about that. It'll go from 115 to 120 volts, which is a big effect, comparable to the effects he was looking at."** Here, the senior advisor to the US Secretary of Energy shows that he does not know the most basic fact about the stabilized power supply used by the Stanford University cold fusion researcher he was criticizing. [*Bad Science*, 1993]



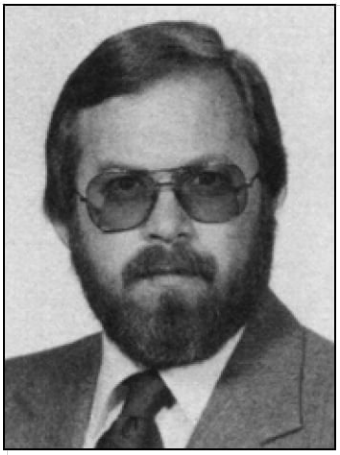
θοην Μαδδοξ, editor of *Nature* at the time of the cold fusion announcement: "**End of Cold Fusion in Sight—Although the evidence now accumulating does not prove that the original observations of cold fusion were mistaken, there seems no doubt that cold fusion will never be a commercial source of energy....It seems the time has come to dismiss cold fusion as an illusion of the past four months or so." [editorial in Nature, July 6, 1989]— "I think it will turn out after two or three years more investigation that this is just spurious and unconnected with anything you could call nuclear fusion — thermonuclear fusion. I think that broadly speaking, it's dead, and it will remain dead for a long, long time."** [in NOVA television program "Confusion in a Jar," broadcast in 1991]

Προφ. Στεωεν Κοονιν, Caltech, also on DoE 1989 Cold Fusion Panel]: "**My conclusion is that the experiments are just wrong and that we are suffering from the incompetence and delusion of Doctors Pons and Fleischmann. ..... It's all very well to theorize how cold fusion in a palladium cathode might take place ...one could also theorize about how pigs would behave if they had wings. But pigs don't have wings."** [at Baltimore, Maryland, APS Meeting, May 1, 1989, the day of Parker's MIT press conference]—"**Although cold fusion excited our imagination, in the end it was just another corrected mistake."** [Professors Steven E. Koonin and Nathan Lewis, Caltech, *The Los Angeles Times*, May 25, 1990.] (*Photo above and to the right: Courtesy, California Institute of Technology*)

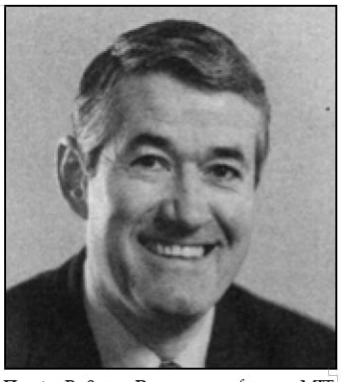
Προφ. Νατηαν Λεωισ, Caltech: Cold fusion is characterized as **"an electrochemist's wet dream"** -- if it were true. [Gary Taubes, citing Prof. Nathan Lewis's opinion, in *Bad Science: The Short Life and Weird Times of Cold Fusion*, 1993. Nathan Lewis's erroneous conclusions about his cold fusion experiments were published in *Nature*. *Nature* refused to publish technical critiques by three scientists of Lewis's so-called "negative results." These critiques were then published elsewhere.]— "**You can go out an get a reading on me. I did things and got the respect of a fair number of people by going into an area that people have studied already and doing things meticulously and seeing things other people didn't see. So I'm one of those people, where you say, 'If Nate says it's right, it's right.'"**[quoted in G. Taubes' *Bad Science*] [Note: Lewis got his Ph.D. under Mark Wrighton at MIT... see adjacent Words]



Προφ. Μαρκ. Ωριγητον, head of Chemistry Dept. at MIT at time of cold fusion announcement, like Happer (above) on the 1989 DoE "unbiased" cold fusion panel, later Provost under MIT President Charles Vest. Wrighton is co-author with Prof. Ronald Parker, Dr. Richard Petrasso, and Prof. Ballinger and others of so-called "negative" MIT cold fusion calorimetry experiment: "**Unfortunately, I have not had time to review your various pieces of correspondence with me concerning our work directed toward establishing the validity of claims concerning cold fusion. Let me be perfectly clear with you: we have obtained no evidence whatsoever to verify the original claims by Pons and Fleischmann concerning cold fusion. I believe that we have indicated the nature of the errors involved in the calorimetry that we have done and do not believe that there is experimentally significant evolution of 'excess heat'."** [October 10, 1990 letter to Dr. Vesco Noninski] (*Photo: MIT News Office*)



Προφ. Ροναλδ Γ. Βαλλινγερ, MIT Associate Professor of Nuclear Engineering: **"It would not matter to me if a thousand other investigations were to subsequently perform experiments that see excess heat. These results may all be correct, but it would be an insult to these investigators to connect them with Pons and Fleischmann. ... Putting the 'Cold Fusion' issue on the same page with Wien, Rayleigh-Jeans, Davison-Germer, Einstein, and Planck is analogous to comparing a Dick Tracy comic book story with the Bible."** [In The *Gordon Institute News*, March/April 1991](*Photo: MIT Faculty Book, 1989*)



Προφ. Ροβερτ Βιργενεαυ, former MIT Physics Dept. Head, now Dean of Science at MIT: **"How did these flakes get on campus?"** [Message to head of MIT News Office, attacking cold fusion theorists who were invited by other professors to speak at MIT in the spring of 1991.] (*Photo: MIT Faculty Book, 1989*)

Δρ. Ριχηαρδ Δ. Πετρασσο, MIT hot fusion scientist: **"I was convinced for a while it was absolute fraud. Now I've softened. They [Pons and Fleischmann] probably believed in what they were doing. But how they represented it was a clear violation of how science should be done."** [*New York Times*, Sunday, March 17, 1991, page 1]— **"Petrasso said he thought there was a 'one in a trillion' chance that the claims of cold fusion are correct."** [quoted in *Boston Globe*, April 17, 1992 article by David Chandler]— "**If you buy the excess heat measurements then you have to invent some kind of nuclear process to explain them. I just haven't bought into the heat claims yet. I think there is a subtle mistake...if it's a mistake, it's a very interesting mistake."** quoted in *Popular Science*, August, 1993 article by Jerry Bishop] **"The ongoing reports of excess heat and nuclear by-products catch people's attention about as much as the occasional UFO report. I have better things to do with my time."**[quoted in *TWA Ambassador* article by Bennett Daviss, Sept. 1997](*Petrasso photo by Eugene Mallove—at First Annual Conference on Cold Fusion in Salt Lake City, 1990. Petrasso went as Nature Magazine's "Rambo" — nick name on Nature magazine's fax to him: "Get 'em Rambo!")*

Boston Herald

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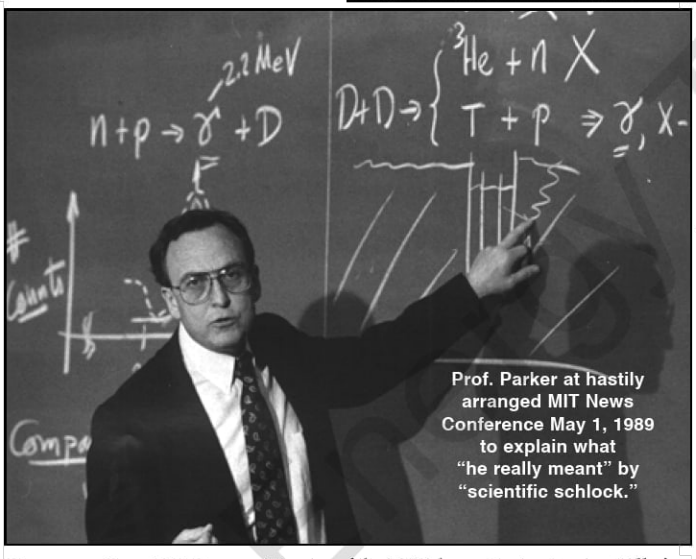
MIT bombshell knocks fusion 'breakthrough' cold

President Charles M. Vest of MIT —1991 through present



Prof. Parker at hastily arranged MIT News Conference May 1, 1989 to explain what "he really meant" by "scientific schlock."

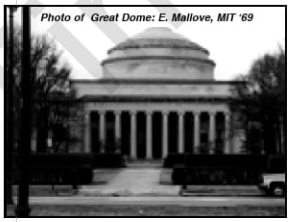


Photo of Great Dome: E. Mallove, MIT '69

Προφεσσορ Ροναλδ Ρ. Παρκερ, Director of the MIT Plasma Fusion Center: **"I'll give you a quote: This is scientific schlock, O.K. .....So what are you going to do with this Nick, what you're hearing is we think it's a scam, right?"** [to *Boston Herald* reporter, Nick Tate in an interview (April 28, 1989) about the Fleischmann and Pons work. This led to *Boston Herald* headline on May 1, 1989, **"MIT bombshell knocks fusion 'breakthrough' cold."** Parker publicly denied the substance of the *Herald* story, even though his words above — and the use of the word **fraud** five times during the interview with Tate had been captured on audio tape.]

"**Unfortunately, a lot of time and effort has been wasted due to this blunder."** [Describing cold fusion to author Robin Herman, May 11, 1989 — *two months before* data from the MIT Plasma Fusion Center cold fusion calorimetry experiment were analyzed in July. Parker *et al* held a "Wake for Cold Fusion" Party on June 26, 1989.] **"MIT scientists intensely investigated the phenomenon called 'cold fusion' for two months in 1989. Like other scientists around the world, they were unable to duplicate the Pons and Fleischmann experiment They have concluded that, while the reaction termed cold fusion is scientifically interesting, it is not one which is valuable for them to pursue at this time."** Part of a statement faxed to the media by the MIT News Office for the Plasma Fusion Center (August 30, 1991—after Eugene Mallove resigned and challenged the so-called "negative" Plasma Fusion Center cold fusion calorimetry experiments as egregious scientific misconduct— data fudging and subsequent coverup. (***Photo: MIT News Office, 1989***)

In the summer of 1991, Eugene Mallove requested President Charles M. Vest to an in depth review of his allegations of scientific misconduct at the MIT Plasma Fusion Center (PFC) on a Federally funded experiment to verify or reject the excess heat claims of Pons and Fleischmann. That experiment had measured excess heat. The data was fudged and published as a null result in a "peer-reviewed" journal edited at the MIT Plasma Fusion Center. After a thoroughly unsatisfactory review of the events in 1989 at the PFC, President Vest ended further consideration of Mallove's allegations of scientific fraud on a Federally funded experiment, as well as the unethical behavior in news manipulation by Prof. Parker (noted in the adjacent material). *The earlier letter (below)signed by* both *President Vest and Provost Wrighton is thus all the more ironic. Wrighton was a co-investigator of the MIT PFC experiment. Integrity in the conduct of academic research? What integrity?*

August 12, 1991

To members of the MIT community:

We have received a progress report from the Committee on Academic Responsibility. It is now being distributed widely to the MIT community to stimulate dialogue on the issue of integrity in the conduct of academic research. The committee plans to use this document in discussions with members of the community and as a basis for its final report which is expected in the middle of the coming academic year.

We believe that the progress report provides an excellent framework for a discussion of how the Institute maintains the integrity of academic research on our campus and of how we discharge our stewardship to the public for its support of scientific research. You are encouraged to review the report and to discuss it with your colleagues. Please feel free to convey your views to the Committee on Academic Responsibility or to us.

We also believe that the increased dialogue and debate on these issues this fall will promote greater understanding about the conduct of academic research, an enterprise that is vital to the nation.

Charles M. Vest — Mark S. Wrighton

Dieter Britz, a Knowledgeable Skeptic

by Jed Rothwell

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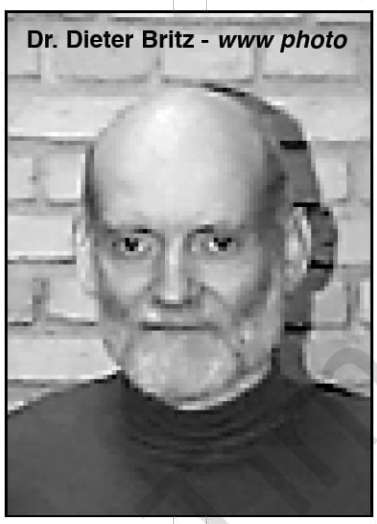
Most professional scientists ignore cold fusion. A small group of self-styled "skeptics" attacks it. They gather on Internet discussion groups, particularly *sci.physics.fusion*. Only a few people have written formal papers or books attempting to refute cold fusion: Jones, Close, Morrison, Huizenga, Taubes and Hoffman. Most skeptics know little about the cold fusion literature. In my opinion, only one has a solid grasp of the literature and extensive professional knowledge of electrochemistry. Only one has read the literature in detail: Dieter Britz, of the Chemistry department at Aarhus University, in Denmark. He is an electrochemist. He is presently working on computer simulations of "the solution of Fick's diffusion equation, with the special boundary conditions given by the electrochemical context."[1] Previously he has worked on corrosion, electrosynthesis, electroanalysis, adsorption and instrumentation.



Dr. Dieter Britz - *www photo*

Britz maintains an extensive bibliography of peer-reviewed cold fusion papers on the world wide web: *http://kemi.aau.dk/~db/fusion*. Our *Infinite Energy* web page *http://www.infinite-energy.com* has pointers to this bibliography, which I recommend. I also recommend the electronic bibliography published by Hal Fox (Fusion Information Center, Salt Lake City).[2] The Britz bibliography has two main sections: a list of titles alone, and a list of the same titles with brief descriptions of the papers, divided alphabetically by author. He has a section with short reviews of books, and a section devoted to mass media reports of cold fusion. The descriptions are serviceable if you know the field, but I find them subtly biased. The descriptions of some leading books and papers are grossly biased.

As far as I know, Britz and Steve Jones are the only skeptics who published formal experiments to test their doubts about cold fusion after 1989. Jones claims that mixing and recombination problems produce artifactual excess heat in all experiments.[3] for reports of excess heat in 'cold fusion' cells," *J. Phys. Chem.* 99 (1995) 6973. Skeptics suggested that Pons and Fleischmann may have had difficulty measuring input power because of fluctuations. Britz determined this is not the case.[4] In Internet discussions, he explained:

> The fluctuations are mainly due to the bubbles covering parts of the cathode, thus varying the active area, as well as (to a lesser extent) solution resistance. The fluctuations do not go to frequencies that a normal constant current device cannot handle. We looked into this (believing, before we started, that F&P had made a serious mistake) and found, as I wrote before, that the current is practically constant. All they had to do - and most likely did do - was to provide an LP filter. F&P do know about the sampling theorem. I believe that their power estimations were correct.

He remains a skeptic. He thinks there is only a small chance that some excess heat and tritium findings are real, and he dismisses claims of host metal transmutations. He calls himself "even handed," he says he does not like the controversy that surrounds cold fusion. In a letter to me, he wrote:

> I am trying to be evenhanded, that is all. There is too much bullshit on both sides and I don't belong to either side in this - except the recent outgrowths, which I definitely regard as 100% bullshit - transmutation, excess heat from stirring water, sub-basement electron shells. I wouldn't do anything to torpedo that work (and have no influence anyway) but am definitely on The Other Side, yes. There are enough quality positives for the original F&P system (tritium, some XS heat) to force me to give it a (small) chance.

"Transmutation" refers to heavy element transmutation. Britz thinks there is a small chance that hydrogen isotopes transmute to form tritium, but he categorically rejects palladium and gold transmutations reported by Bockris, Mizuno, Ohmori and others. "Stirring water" refers to the Griggs HydroSonic™ Pump experiments. "Sub-basement electron shells" refers to the theories of Randall Mills. He amplified this comment:

> OK, here I will make a confession. On these subjects: what you call LENT [Low Energy Nuclear Transmutations], and the Mills scenario or free-lunch energy from stirring water, my mind is closed totally, until the evidence is hard enough to hit me over the head. When I see those people selling Pt or Os or whatever, I'll believe it. Until then I'll take the attitude that known theory says none of these can happen. I don't know how all those people you line up get the results you say they get, but I don't go for it. . . .

One wonders how he expects the results to hit him on the head when he refuses to look at the papers and he has no idea how the experiments are performed ("I don't know how those people . . . get the results.")

Britz's bibliography and his experiment measuring power are important, positive contributions to this field. His careful, skeptical attitude is welcome. But he goes too far, to the point of intellectual dishonesty. He comes up with too many trivial objections to experiments. He repeats these objections even after leading scientists point out his mistakes. He has other bad habits common to skeptics: He practices reductionism to the point of absurdity, refusing to consider the totality of the evidence. He arbitrarily rejects data. He is too closed-minded, too conservative, and he resorts to too many cheap rhetorical tricks and intellectual games to reject or ignore solid data.

His careful, skeptical attitude is welcome. But he goes too far, to the point of intellectual dishonesty. He comes up with too many trivial objections to experiments. He repeats these objections even after leading scientists point out his mistakes.

I acknowledge his contributions, but on balance I think Britz adds more confusion than light to this debate. This is tragic. He has broad knowledge of the field, and he writes incisive critiques of experiments, but for the most part he squanders his talent nit-picking and introducing confusion. The paragraphs quoted above illustrate his infuriating closed-minded attitude. I responded to this by making several points about the transmutation claims and the Griggs experiment:

Heavy element transmutations have been observed by

New Energy Times Archive

Bockris, Miley, Ohmori, Mizuno, Enyo and others. These are leading electrochemists who Britz professes to admire and whose judgement he generally trusts.

Ohmori and Mizuno's results were verified in blind tests performed at four major Japanese laboratories: Hitachi, Mitsubishi, Nissan and Meidensha corporations. They used four different spectrometer types: SIMS, EDX, AES and EPMA. They found unnatural isotopes in dozens of elements, and a thousand times more iron (with peculiar isotopes) than can be accounted for by contamination. Copper-63 alone was found, with no copper-65. In the blind tests, unused cathodes and cathodes that did not produce heat showed no isotopic anomalies.

Bockris and Minevski, and Ohmori, Mizuno and Enyo devoted years to these experiments. Ohmori has repeated the gold experiment more than 50 times. Exhaustive steps were taken to eliminate contamination and verify the isotope shifts. The conclusions were not arrived at lightly. No honest scientist should reject them without careful consideration and a good reason. A careful scientist may not accept these results until they have not been widely replicated, but he will not blindly reject them.

The Griggs experiment was designed under contract by the Emeritus Dean of Mechanical Engineering at the Georgia Institute of Technology. It was installed and tested by a leading Atlanta engineering firm, using top-of-the-line equipment. The excess heat is well above the noise level. The effect has been seen at other locations. This is engineering, not science, so a scientist may wish to reserve judgement or bow out of the discussion. Britz does not bow out; he roundly condemns these findings, although he will not give a reason.

John O' M. Bockris, one of the world's top electrochemists, wrote Britz a note suggesting that he rethink his views on transmutation. Britz declined. He did not justify or defend his statements. He did not apologize to Bockris for calling his work "bullshit." He will not examine the evidence. Britz places great stock in authority. He claims he respects leading electrochemists like Bockris and Enyo, but he adamantly refuses to look at their transmutation evidence. I think this is a betrayal of science, the experimental method, academic ethics, and common sense. A scientist should never condemn a paper he has not read.

An Example of Intellectual Dishonesty

We all have our limitations. We are closed-minded about some things. Some people blindly reject transmutations, yet they objectively examine other aspects of cold fusion. Britz talks as if he would. He often cautions hardline skeptics. When someone wrote that Pons and Fleischmann have no experience in calorimetry, he responded:

> [Fleischmann] at least is a very prominent electrochemist and has worked in much more than microelectrodes. It would not surprise me if he has done calorimetry in the past. Certainly a scientist of his calibre would have no trouble quickly assessing the pitfalls in doing calorimetry, even if it were new to him. Calorimetry is not as far from electrochemistry as, say, neutron measurement. I am myself skeptical of F&P's claimed accuracy (0.2% I think it was), but I would not dismiss their results simply on the basis that they were new to that; that is too facile. You have to point out where they went wrong. I believe there are in fact points of attack in their work. The same goes for Will and his tritium results; I don't believe he ever assayed for traces of tritium before he started CNF work, but I doubt if anyone here can find flaws in their tritium papers (Will et al., *J. Electroanal. Chem.* 360 (1993) 161.

He says he knows "points of attack" but after several years of debate, he has listed only one: thermal gradients, which cause poor mixing. A gradient might cause a thermocouple or thermistor the register a higher or lower temperature, which would look like excess heat or "excess cold." ("Excess cold" means hot water is channeled away from a thermocouple, making the cell look as though an endothermic reaction was underway.)

Getting back to his analysis of the input power problem, he wrote:

> [Pons and Fleischmann] used a constant current generator and thus the input power was (or was thought to be) exactly the current multiplied by the total cell voltage's time average, quite easy to measure. They did make a mistake in their circuit, that could have introduced fluctuations in the "constant" current - and probably did, as described by Holst-Hansen & Britz, *J. Electroanal. Chem.* 388 (1995) 11. Theoretically, in such a case, the power calculated in the above way could be out, IF: the fluctuations are correlated with those of the cell voltage, AND if they were of appreciable magnitude. We reported in the paper that neither would be the case, so their power calculations were in error by an insignificant amount. In my opinion, the major error source in their work would be the assumption of no temperature gradients, i.e. that the single thermistor showed the true temperature in the cell. They reckoned they had fast mixing and thus no such gradients but we know now that this may not be so. I believe Storms has concluded this from his recent work. Much more about all this has been said in the recent papers by Jones et al.

(Melvin Miles and I believe the Jones paper has no merit, as explained below.) Britz later added:

> As I wrote before, I believe the error - if it was, which I regard as most likely but wouldn't state categorically - is more likely to be in the single thermistor measurement, i.e. neglect of temperature gradients in the cell. From others' work we know that there are such gradients, e.g. a significant vertical one, as well as a radial gradient. This would put their results out by considerably more than their stated precision in the measure heats, of 0.2% or so.

When I read this, I was incensed, and I sent him a barrage of reasons why this is not so. I began by quoting a recent message from Melvin Miles, describing a Pons-Fleischmann calorimeter:

> I used two thermistors in my calorimeter. . . . I have also worked with Fleischmann / Pons cells here at NHE. Their calorimeters also use two thermistors in each cell. These two thermistors are located at completely different positions, yet they give almost identical results.

I listed other reasons why this claim makes no sense:

- Many other researchers have performed this experiment with other calorimeter designs in which thermal stratification in the cell cannot be a factor, like flow and Seebeck envelope calorimeters. Systematic errors are ruled out because the calorimeter systems are different.
- Miles and many others have used Pons-Fleischmann style cells with multiple temperature sensors, or they have measured temperature at the cell wall.
- Britz referred here to an early paper. Pons and Fleischmann subsequently used many different designs. For at least three years Pons has been using the Icarus-9 cell, with three sets of two thermocouples.
- Pons and Fleischmann added dye to the electrolyte, to show there is extensive mixing and no thermal gradient, except right next to the cathode, of course. Nobody would place a thermocouple at that spot.
- A 0.2% error, or even 2% or 20% error would not invalidate their high power results.
- During the boil off phase, energy is measured by observing how much water boils away. This method does not rely on the thermocouples, and it cannot be fooled with thermal gradients. The low heat is a precursor to the high heat; the high heat confirms that the low heat was real. Pons and Fleischmann and the French AEC both observed that high heat boil off events are always preceded by a build up of low heat. It makes no sense to suggest that the low heat is an artifact of thermal gradients but the high heat that follows is real.
- As far as I know, there have been no reported episodes of artifactual "excess cold" caused by insufficient mixing. These

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should be as common as artifactual excess heat.

My message to Britz triggered a series of private messages and Internet postings in which he evaded, obfuscated, retracted and unretracted. He is disputing a matter of fact: the number of thermocouples in a cell. He is using this as an excuse to attack Pons and Fleischmann. He began by arbitrarily limiting the discussion to one early paper by Pons and Fleischmann:

> In FPALH-90, the picture clearly shows a single thermistor. No doubt they used more later, but the work for which they are known - that is the basis of all discussion - used one.

I responded:

> Do you mean that we are NEVER allowed to look at later experiments by Pons and Fleischmann, or experiments by McKubre or Oriani? . . . The fact that they and others repeated the experiment successfully hundreds of times with multiple thermistors means nothing. You are stuck in a time warp, mired in March 1989. You will only discuss one experiment; subsequent work must not be considered; we must judge cold fusion on the basis of one preliminary experiment performed by Pons in his basement.

He agreed that another look at the literature might be in order. To his credit, he quickly found out that they did use multiple thermocouples, and he posted a public retraction and apology, something which Huizenga or Morrison would never do:

> This may be the right place for a correction and, to those who got offended, an apology. I got some email because of my statement that F&P used only a single thermistor in their cell. They wrote this in their 1990 paper in *J. Electroanal. Chem.* 287 (1990) 293. However, I did overlook another paper, Pons et al., *Fusion Technol.* 17 (1990) 669, in which they respond to a lot of criticisms of their work, and in that paper they state that, as a check on incomplete mixing they used an array of 5 thermistors (not stating how they were arranged) and that the differences between them did not exceed 0.01°C in most of the cell, rising to 0.02°C near the Kel-F plug at the cell bottom. These values lie at about the precision of their temperature measurement and are thus essentially zero. They compare with 2°C, which they state in 1994 to be the minimum temp. difference they accepted for a measurement, i.e. about a factor of 100 or 1% precision at least. Although in their later paper, *Phys. Lett. A*176 (1993) 118, they again show a figure of a cell with a single thermistor, the (presumably one-time) check with 5 thermistors is evidence that in their cell there were no temperature gradients. I therefore retract my guess that such gradients might be a source of error in the measurement of excess heat and apologise to whomever might have been offended at my making such a guess in my posting last week.

You would think that would end the debate. But, a few days later he was back at it, this time claiming there is "no doubt" Pons and Fleischmann tested for gradients only once. He ignored the message from Miles. He ignored Icarus-9 design. (He has never seen Icarus-9 and he will not look at it, because it is not in the peer-reviewed literature.) He said that in a later work Pons and Fleischmann went back to the single thermistor design:

> . . . I have one paper of F&P's, in which they report the check with 5 thermistors. As I wrote, in a later paper they again show a figure with a single thermistor. This no doubt means that their check convinced them to forget about temperature gradients thereafter, which is not unreasonable, given that they use the same kind of cell and similar current densities (and thus bubble rates). But it is a fact that I know of only one report of the 5-thermistor array.

I think most people would find the 1-thermistor design sloppy. It was good enough for an experiment conducted 10 years ago in Pons' basement, but in the IMRA labs with Toyota's millions, people expect them to do better. Internet readers must be disconcerted to hear from Britz that there is "no doubt" this check "convinced" Pons and Fleischmann, and they have slipped back into their bad old habits. I believe he is trying to denigrate them by spreading a myth. He denies that.

Whatever he is trying to do, this statement is mind-boggling: "But it is a fact that I know of only one report of the 5-thermistor array." He means he knows only one published, peer-reviewed report. He explained, "I go by published information, not phone calls etc." In this case he refuses to "go by" a written statement from Melvin Miles, a distinguished electrochemist. And the issue he disputes with Miles is . . . the number of thermocouples Miles sees in a cell on his workbench.

Miles says he sees two thermocouples, but that is not good enough. Britz demands peer-reviewed proof. The Icarus-9 schematic on the ICCF6 Proceedings shows six thermocouples, but it does not count, because it was not peer-reviewed.[5] In the *Transactions of Fusion Technology*, Vol. 26, p. 329, Pons and Fleischmann reported that radial and axial mixing took ~3 seconds and ~20 seconds respectively.[6] They said they designed the Kel-F cell components to "ensure there are no stagnant zones in the electrolyte." They describe other steps to ensure that cells behave "like well-stirred tanks." This does not count with Britz, because although *Fusion Technology* is a peer-reviewed journal, he arbitrarily rejected this issue. It must not have been peer-reviewed enough for him. This issue has 65 papers on cold fusion. He listed them in his database for a while, then he removed them.

The dispute between us dragged on to absurd lengths. I repeatedly e-mailed him Melvin Miles' statement, and I urged him to contact Miles directly. Britz finally asked: "We were talking about F&P's cell, weren't we? Not Miles, or Enyo, or Mizuno . . ." He reverted to a narrow, legalistic defense:

> The fact is: going by what they have published (not said at meetings or on the phone), all except one paper clearly show the same figure with a single thermistor. In one paper they say that they have made a check. That is all I have to go on.

His demand for certified proof would be appropriate at murder trial, but this is no way to do science. We cannot halt research every time a minor question about equipment arises. We cannot wait three years for the peer review process to grind out an answer. A scientist must reach out for information. He must find out for himself and do his own homework, he cannot depend on journal editors to spoon feed him every detail. When

Britz continued on page 57

Footnotes for Britz article

1. http://kemi.aau.dk/~db/

2. *Bibliography for Fusion Facts and Journal of New Energy*, available from the Fusion Information Center, P.O. Box 58639, Salt Lake City, UT 84158-0639

3. J. E. Jones et al., "Faradaic efficiencies less than 100% during electrolysis of water can account for reports of excess heat in 'cold fusion' cells," *J. Phys. Chem.* 99 (1995) 6973

4. P. Holst-Hansen, D. Britz, "Can current fluctuations account for the excess heat claims of Fleischmann and Pons?," *J. Electroanal. Chem.* 388 (1995) 11

5. T. Roulette et al., "Results of Icarus 9 Experiments Run at IMRA Europe," *Proc. Sixth International Conf. Cold Fusion*, Vol. 1, p. 86

6. M. Fleischmann et al., "Calorimetry of the Pd-D_2O System: The Search for Simplicity and Accuracy," *Transactions of Fusion Technology*, Vol. 26, p. 323

7. McKubre, M. C. H., et al., *Development of Advanced Concepts for Nuclear Processes in Deuterated Metals*, EPRI TR-104195, Research Project 3170-01, Final Report, August 1994, p. 3A 19

8. F. Franks, *Polywater*, (MIT Press, 1981)

9. N. Hoffman, *A Dialogue on Chemically Induced Nuclear Effects*, (American Nuclear Society, 1995)

10. J. Rothwell, "REVIEW: A Dialogue on Chemically Induced Nuclear Effects," Infinite Energy, Vol. 1, No. 3, p. 53

11. G. Taubes, *Bad Science: The Short Life and Weird Times of Cold Fusion*, (Random House, 1993)

12. Taubes, *ibid*, p. 406

13. G. Taubes, *ibid*, p. 271

14. G. Taubes, *ibid.*, p. 229 and elsewhere. Taubes never says why these researchers allegedly did not measure voltage, or where he learned about this. He hints that they simply forgot. A researcher would forget to measure voltage about as often as you would forget to put on your clothes before driving to work.

15. G. Taubes, ibid, p. 229

16. G. Taubes, ibid, 339

17. For example, see: M. Schreiber et al., "Recent Measurements of Excess Energy Production In Electrochemical Cells Containing Heavy Water and Palladium," *First Annual Conf. Proc*, March 1990. This was available long before Taubes wrote his book.

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The Marinov-Motor is Not a Homopolar Motor

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The purpose of this brief note is to refute the common casual analysis of some that the Marinov motor is just an inefficient homopolar machine or "It's all just **i** X **B**". A brief description of the homopolar and Marinov motors will be presented, a possible source of the claim that the two are similar examined, and a description of an experimental result not compatible with a possible homopolar-like interaction to explain the Marinov motor ring rotation.

The Homopolar Motor

Homopolar motors and generators are more genaralized versions of the Faraday disk (Fig. 1). In general, such devices are a flat conductive disk (though also a drum in some configurations) free to rotate inside a magnetic field. (Note: Interestingly enough, it makes no difference if the magnets providing the B field are stationary or actually attached to the disk to corotate with it, provided the current path stays within the field.) Via brushes, current is drawn off (generator mode) or put in (motor mode) between the rim and the axis of the disk. The driving force of the Faraday disk (motor mode) obeys **F** = **iLxB**, where in this case L = r, the radius of the disk. [1]

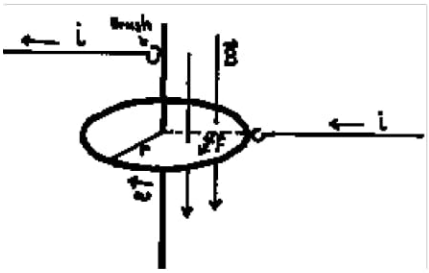

Figure 1. Typical homopolar motor.

Although for practical reasons most homopolar devices are designed with the **B** field going through the disk in only one direction, it is possible to build a homopolar machine in which current is run through the disk along a full diameter provided the **B** fields point in opposite directions on opposite sides of the disk (Fig. 2). Why anyone would build a homopolar motor this way I don't know, but that it can be done is important to understanding the discussion concerning the Marinov motor.

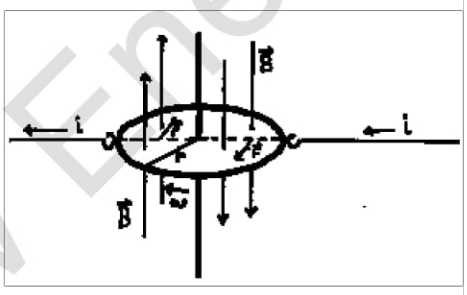

Figure 2. Alternate homopolar motor.

The Marinov Motor

The Marinov motor as fundamentally described by Wesley[2] is illustrated in figure 3. Current arrives at the ring, splits up, and goes around the rectangular magnetic torus (or CMC for closed magnetic circuit) both ways, then recombines at the point where it leaves the ring. (Note: There is an ambiguity in the direction of the confined **B** field in this illustration. By referring to a second illustration in the same article, one can decide that Wesley has the **B** field going clockwise in this picture. Experiments by Phipps, Ligon, and Kooistra demonstrate that the illustration has the direction of ring rotation backwards for some CMC designs. We don't know why this is yet, but it doesn't affect the nature of the discussion to follow.) Ideally, the entire **B** flux would be confined within the interior of the CMC (also called an "armature" when allowed to rotate with the ring fixed), but as a practical matter it is nearly impossible to make a permanent magnet toroid that does not leak. Initial CMCs constructed by both Tom Ligon[3] and Kooistra consisted of powerful stacks of rare earth magnets attached top and bottom to long steel bars. Tom Phipps[4] constructed a CMC with permanent bar magnets capped top and bottom with short soft iron keepers. Each has independently demonstrated that when current is applied to the ring with the armature free to turn, the armature does, in fact, turn. Kooistra has also demonstrated that the ring will turn if free to do so. All have also confirmed that the toroids do, in fact, leak.

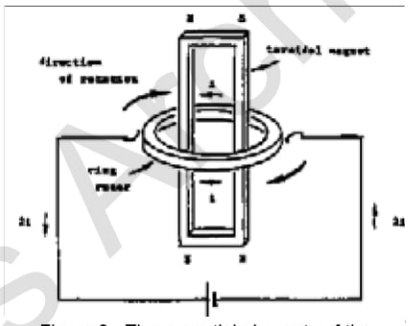

Figure 3. The essential elements of the Marinov motor (taken from Wesley).

First attempts by Ligon, Phipps, and Kooistra at building these motors utilized flat copper flanges of various sizes supplied by Tom Ligon. These rings have an inside radius Ri and outside radius R_o, for a disk width of $R_o - R_i = \Delta r$. Since the **B** field in the CMC at no time intersects the metal of the disk, one might assume that the ring rotates (or the armature moves) because of B field leakage interacting with the ring (Fig. 4). (It is hard for this author to imagine any other way in which one might confuse the Marinov motor with a homopolar machine.) If this is true, then the force acting on the CMC should be directly proportional to the width of the ring, Δr. Hence, the force acting on the disk should be **F** = **i**L x **B**, where L is taken as being about equal to 2 Δr. (In the real world

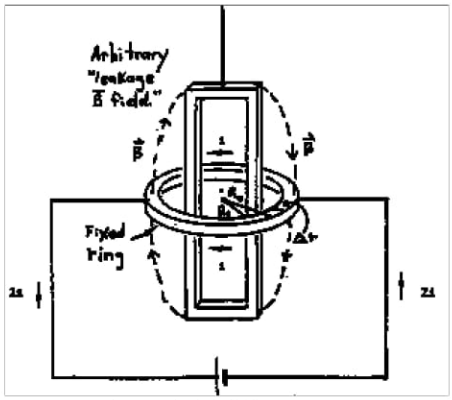

Figure 4. Field leakage.

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of leakage fields, **B** on the left side would also likely differ from **B** on the right side in both magnitude and direction at the position of the ring.

A Simple Experiment

One could go about measuring leakage **B** fields and current and calculate the force on the ring, but it should be obvious that if we allow $\Delta r \rightarrow 0$, then **F** will go to zero if the ring rotates for the same reason that homopolar motors do. But why do a calculation when a simple experiment will show that the ring rotates (or for this experiment, the armature turns) apparently for reasons having nothing to do with **F** = **i**L X **B**?

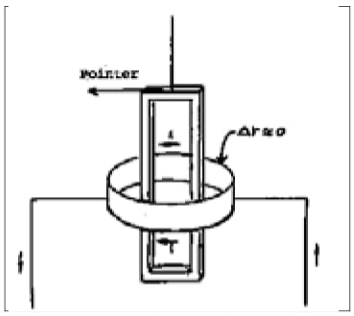

Figure 5. Thin-walled shell experiment.

Suspend a CMC armature with a fairly stout copper wire such that when current is applied to a fixed ring, the armature will only deflect some convenient number of degrees less than 90 (a small pointer on the armature and a protractor will suffice to measure this angle) until back torque from the suspension wire stops it. Note this deflection. Replace the ring with a thin conducting shell (Fig. 5) (aluminum foil on a cardboard form works nicely), with radius about egual to the geometric average radius of the inner and outer radii of the original ring. Since the L term is now reduced to almost nothing, it would be expected from the homopolar explanation that **F** would become almost nothing and the armature deflection should also be almost nothing.

When current is applied it is found that armature deflection is the same in both cases. Thus, the Marinov motor is not some kind of homopolar motor.

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1. *The Homopolar Handbook*, Thomas Valone, M.A., P.E., Integrity Research Institute, 1994.
2. J. P. Wesley, "The Marinov Motor; Induction with No B Field," Nov. 1997 (To be published)
3. Tom Ligon, Assorted Technical Expertise. Private communication.
4. Thomas E. Phipps, Jr. Private communication.

Breaking News on Marinov Motor:

Since writing the above paper, I've done some additional experimentation and thinking about rings vs. shells in Marinov motors. I've actually put a thin shell into motion and noted NO delta r dependency just as I expected. However, in doing so I also noticed that the expected rotation direction given by Lorentz force considerations (assuming a rather "short" torus) of radial component leakage **B** field acting on presumed vertical **i** components in the shell (the only interactions that supply a tangential push) is exactly the reverse of what is observed. In short, the thin shell experiment not only violates the Lorentz predictions quantitatively, but qualitatively as well! A full report on leakage fields and the Marinov motor is forthcoming in *IE*. — ***Jeff Kooistra***

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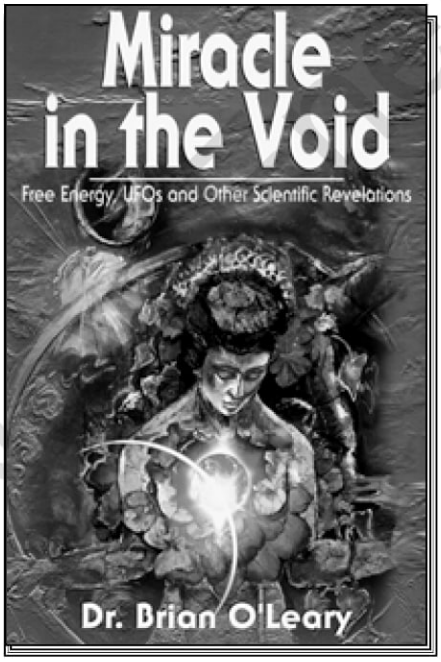

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ICCF-7 News
Vancouver, Canada April 19-24, 1998

March 23, 2998
RE: **ICCF-7- April 19-24, 1998 Vancouver, Canada**

ICCF-7 is now a little over a month away. If you plan to attend, and haven't yet registered, please do so immediately. All payments after the April 3rd cutoff date must be completed on-site in Vancouver. The acceptable form of payment for on-site registration of a participant is either $725 Canadian dollars cash or a suitable bank check for $500 USD. Unfortunately, credit cards can not accepted.

To enhance value, we have included a daily continental breakfast for all registered participants as well as a complimentary travel umbrella in your welcome package. We have finalized plans for a delightful Wednesday eve buffet dinner cruise aboard the M.V. Britannia. Please consult the "Last Minute Travel Planner" below for additional details.

If you were selected to give an oral or poster presentation at the conference, please carefully review your information that was sent. All presenters are expected to submit their final manuscripts in Vancouver for inclusion in the ***ICCF-7 Proceedings*** that is scheduled for release by mid-summer.

April 19-24 should be an informative and enjoyable week. Please plan to join us now. See you in Vancouver!

Best wishes,
Fred Jaeger
Organizing Chairman

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ICCF-7 Last Minute Travel Planner

Registration desk: The **ICCF-7** registration desk will be located in the ground level lobby of the Vancouver Trade & Convention Centre. It will be open Sunday, April 19th, from 13:00 until 21:00. The desk will reopen Monday, April 20th, in the main lobby from 07:30 until 12:00. The rest of the week, it will be located just outside the entrance to Ballroom B. Registration staff will be available at other times by local cell phone at 604-219-0314 or 219-0315. Each registered participant will receive a name tag together with other materials at the registration desk. All participants are required to wear their name tags throughout the week, otherwise they may not be admitted to conference functions.

Vancouver weather: Plan on April average daytime temperatures of 58• F (14• C) with 50% sunny days along with occasionaI spring showers. Evening temperatures wi 11 be 10-15• F cooler. Complimentary travel umbrellas will be provided to each participant at the registration desk.

Attire: Vancouver is an active, informal city. Pack comfortable clothing to suit an informal environment. Conference participants will probably wear a sport coat or sweater (tie optional) for the reception and conference sessions. Informal attire will also be appropriate for the Companion day-trip program. The Wednesday eve sunset buffet and cocktail cruise will take place on board the M.V. Britannia from 610PM. Please wear informal, layered clothing for this event. On the Britannia, rubber bottom shoes are recommended for walking on decks and stairways.

Money: There are several currency exchange booths just outside the baggage claim area at Vancouver International airport. There is also a Thomas Cook travel office in the lobby of the conference center (phone 604-641-1229; closed Sunday).

If you have not already prepaid your **ICCF-7** registration fee, please do so before the cutoff date of April 3rd. Payments after that date should be made on-site and must be in the form of either $725 Canadian dollars cash or a suitable check for $500 USD. Unfortunately, no credit cards can be accepted for payment of registration fees.

Food: With the value-added inclusion of daily continental breakfasts, non-conference meals are limited to Monday, Tuesday, and Thursday evenings. Food choices range from $5 meals in the food court adjacent to the conference center to full $25-35 dinners at several nearby restaurants.

Communication: If you have a need to remain in constant contact with your colleagues, cell phones can be rented in Vancouver for $49/week plus $0.79/minute of local usage (long distance charges extra). To acquire a pre-assigned Vancouver cell number, phone Rent Express Company at 604-713-7368.

Copying services: There is a Xerox Business Center within the upper lobby area of the Pan Pacific Hotel/**ICCF-7** Conference Centre complex to handle a full line of last minute needs including copying, faxing, printing, graphics, transparencies, etc. at phone 604-669-8727.

Local phone contact: You may contact Fred Jaeger, Organizing Chairman, in Salt Lake City until April 16th. From April 17- 24th, he can be reached at the Pan Pacific Hotel (phone 604 662-8111, fax 604-685-8690) or by cell phone at 604-219-0315.

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Seven percent (7%) savings are available for all hotel expenditures and tangible goods which exceed $50 and are purchased in Vancouver by non-Canadians! All purchases in British Columbia are subject to a 14-17% sales tax, of which, a 7% portion is refundable. Refund application forms will be included in your **ICCF-7** welcome package.

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CALENDAR

1996 International World Energy System Conference
June 19-21, 1996
Toronto, Canada

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College Station, Texas
Sept.13-14, 1996

ICCF6—Sixth International Conference on Cold Fusion
October 13-18, 1996
Hokkaido, Japan

Building Energy—Insuring a Sustainable Future
March 12-15, 1996
(Sponsor: Northeast Sustainable Energy Association)
Cromwell, Connecticut

International Symposium on New Energy
(Sponsor: Academy for New Energy)
May 23-26, 1997
Denver, Colorado

International Tesla Society Meeting
July 10-13, 1997
Colorado Springs, CO

Cold Fusion Conference
Asti, Italy
November 27-30, 1997

ICCF7—Seventh International Conference on Cold Fusion
April 19-24, 1998
Vancouver, CANADA

Russian Conference "Fundamentals of Natural Sciences
St. Petersburg, Russia
June 22 - 27, 1998

Institute for New Energy Symposium
Salt Lake City, Utah
August 14-15, 1998

Infinite Energy Magazine's **Cold Fusion and New Energy Symposium 1998,** October 11, 1998
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TAPE #1

Dr. Eugene F. Mallove (Cold Fusion Tech.)
"Cold Fusion and New Energy Technology - An Overview"

Dr. Peter Graneau (Northeastern Univ. for Electromagnetic Research)
"Anomalous Forces in Water Plasma Explosions"

TAPE #2

Buford ("Ray") Conley
(MIT, graduate student, Dept. of Aero/Astro Eng.)
"Light Water Excess Heat Experiments"

Fred Jaeger (ENECO, Salt Lake City)
"Patents and Commercialization"

Professor Peter L. Hagelstein
(MIT Dept. of Electrical Engineering and Computer Science)
"Cold Fusion: What We Know and What We Don't Know"

TAPE #3

Professor Peter Hagelstein (Continued from TAPE #2)

Professor Keith Johnson
(MIT Dept. of Materials Science and Engineering)
"Progress in the Theory of Excess Heat" *and Excess Heat*- The Movie, now being made by Hollywood!

James L. Griggs
(Hydro Dynamics, Inc., Rome, Georgia, USA)
"The Hydrosonic Pump: Excess Power and Other Effects"

TAPE #4

Bertil Werjefelt (PolyTech(USA), Hawaii)
"Energy from Magnetic Materials and Magnetic Fields"

Dr. Eugene F. Mallove(Cold Fusion Technology,
Concluding Remarks

The tapes include the speakers' presentations as well as question and answer sessions. There is footage of the Hydrosonic Pump under test as well as close-up footage of rotor surface melting effects. Bertil Werjefelt shows footage of experiments in his own laboratory. There are scenes of Japanese researchers from Sumitomo, Hitachi, and other companies and universities now involved in their claimed extraction of energy from magnetic materials. These efforts are now said by these researchers to be proceeding toward commercialization. Actual experiments are seen in progress. The tapes are VHS cassettes in NTSC format and range from 120 to 127 minutes each.

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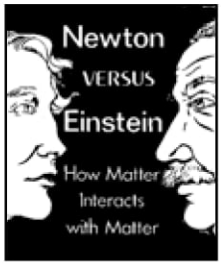

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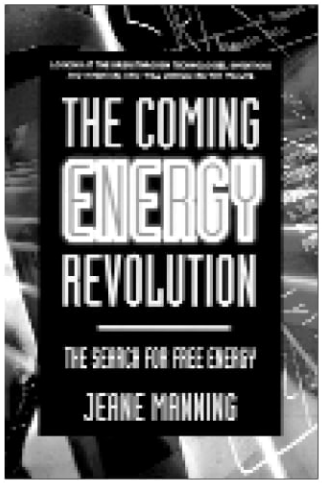

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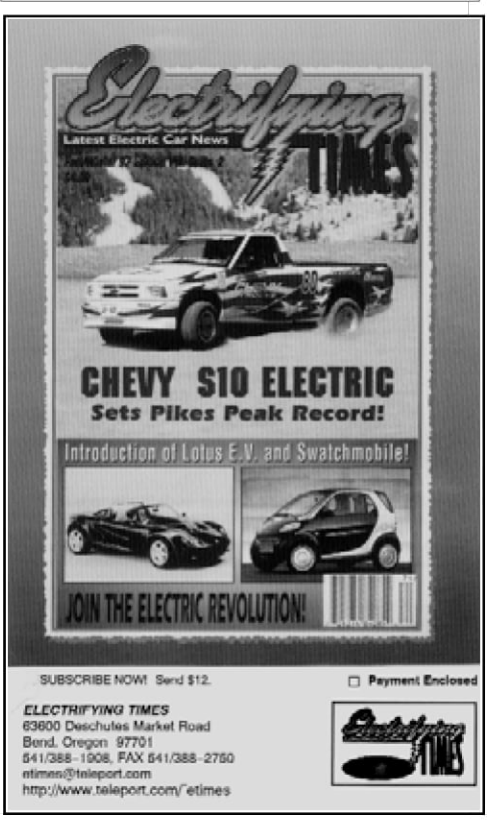

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See: "Nuclear Augmented Combustion" page 11

United States Patent

Berenyi

Patent Number: 4,668,247
Date of Patent: May 26, 1987

HYDROGEN ENERGY RELEASING CATALYST

Inventor: Szilard Berenyi, Northvale, NJ
Assignee: Fusion Aided Combustion Technology International Corporation Northvale, N.J.

Appl. No.: 780,090

Filed: Sep. 25, 1985

Int. Cl. 4 ..... C10L 1/18
U5. Cl. 44/68; 44/66
Field of Search 44/68

References Cited
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Primary Examiner —William R. Dixon, Jr.
Assistant Examiner —Ellen M. McAvoy
Attorney. Agent or Firm —Yusuke Takeuchi

Abstract

A hydrogen energy releasing catalyst comprises a liposoluble organometallic lithium and a vehicle or diluent oil. A process for preparing the aforementioned catalyst which comprises dissolving or dispersing a liposoluble organometallic lithium in a vehicle or diluent oil. A method of using the aforementioned catalyst which comprises adding it to a hydrocarbon fuel at a specified catalyst-to-fuel ratio according to the type of fuel and the combustion device used. In the ease of a gasoline or diesel internal combustion engine, the mileage increases from 15% to 35%, while in a furnace or boiler, the fuel efficiency increases from 20% to 35%.

6 claims, 1 Drawing Figure

HYDROGEN ENERGY RELEASING CATALYST
BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a composition of matter for harnessing the hydrogen energy of a hydrocarbon fuel. a process for preparing it, and a method of using it.

2. Description of the Prior Art

Lithium stearate is well known as a lubricant or lubricating oil improver.

It has now been discovered that lithium stearate and other liposoluble organometallic lithium compounds can be used for harnessing the hydrogen energy of hydrocarbon fuels.

SUMMARY OF THE INVENTION

One aspect of the present invention concerns a hydrogen energy releasing catalyst which comprises a liposoluble organometallic salt or salts and a vehicle or di-luent thereof.

Another aspect of the present invention concerns a process for preparing the aforementioned catalyst which comprises dissolving or dispersing a liposoluble organometallic salt or salts in a vehicle or diluent oil.

Another aspect of the present invention concerns a method of using the aforementioned catalyst which comprises adding it to a hydrocarbon fuel at a specified catalyst-to-fuel ratio according to the types of fuel and the combustion devices used. In the case of a gasoline or diesel internal combustion engine, the mileage increases from 15% to 35%, while in a furnace or boiler, the fuel efficiency increases from 20% to 35%.

BRIEF DESCRIPTION OF THE DRAWING

FIG. l is a graph showing the relationship between the torque and the number of revolutions of a test engine.

DETAILED DESCRIPTION OF THE INVENTION

The hydrogen energy releasing catalyst according to the invention comprises from 10% to 90% by weight of at least one liposoluble organometallic salt or salts and from 90% to 10% by weight of a vehicle or diluent thereof

The liposoluble organometallic salt or salts useful for the present invention are composed of a metallic cation and a carboxylic acid anion. The carboxylic acids for the invention are selected from saturated or unsaturated fatty acids having 2 to 32 carbons, preferably from 15 to 27 carbons, most preferably from 15 to 18 carbons. Example of such carboxylic acids are stearic, oleic, and palmitic acids. The metallic cation has a valence of I to 4. Examples of the preferred meta] are sodium, potassium, lithium, magnesium, aluminum, and silicon.

The organometallic lithium is the principal and most active catalytic ingredient capable of harnessing the huge physicochemical energy of the hydrogen atom of a hydrocarbon fuel at temperatures reached by an ordinary combustion engine or furnace. Example of the preferred organometallic lithium are lithium stearate, lithium oleate, and lithium palmitate.

The organometallic magnesium alone requires very high temperatures and high heat rates to be an active hydrogen energy catalyst. The energy gain by its use alone would be small in an ordinary combustion engine or furnace. However, when the organometallic magnesium is added to the organometallic lithium in the ratio of about 1:2 by weight. there is a greatly improved release of atomic hydrogen. This also results in a decrease in the amount of pollutants in the exhaust gas. Another benefit of its use is improvement in the solubility or dispersibility of the composition in a hydrocarbon fuel.

The organometallic aluminum does not participate in the catalytic reaction of a hydrocarbon fuel. However, when it is mixed with the organometallic lithium and organometallic magnesium in amounts about 1/4 by weight relative to the amount of organometallic lithium. it increases the pollutant absorbing power and the solubility or miscibility of the composition in the fuel.

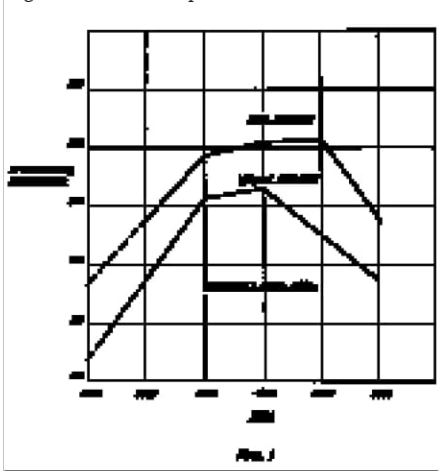
Another optional ingredient is a peroxide oxidant or co-catalyst such as lipsoluble benzoyl peroxide or metallic peroxides in amounts from 0.1% to 12%, preferably from 1% to 3% by weight of the composition, to help speed up the interaction of components of the composition for activating them. The vehicle useful for the invention includes aliphatic cycloaliphatic, parafinic, olefinic and aromatic hydrocarbons, and other natural, silicon-based. or silicon-substituted synthetic oils, such as castor oil, alkyl glycols, and tetraethylsilane, and mixtures thereof. The amount of a vehicle is from 10% to 90%, preferably from 60% to 80%, by weight of the composition. The preferred aromatic hydrocarbons are of the naphthenic series in amounts preferably from 0.1% to 15%, most preferably about 5% by weight, of the vehicle.

The composition of the invention may be prepared by dispersing or melting and then blending one or more of the afore-mentioned organometallic compounds with one or more of the afore-mentioned vehicle oils. The resultant dispersion or solution is then heat cycled for a specific time at specific temperatures and pressures described below. Finally, it is cooled, and, if desired, other ingredients, such as oxidation promoters, are added.

More specifically, one or more of the organometallic compounds arc placed in an autoclave, which is filled with an inert gas, such as helium, and heated at temperatures between 50° and 800° F., preferably between 80° and 495° F., most preferably at about 360°, for melting. Throughout the preparation, the pressure is kept at from one to 30 atm, preferably from one to 10 atm. After the organometallic compounds are melted, the temperature is adjusted to between 250° and 500° F., preferably between 300° and 360° F, and vehicle components are added and the blend held at this temperature for a period of from 5 minutes to 12 hours, preferably from 15 minutes to 6 hours, most preferably about 3 hours. The blend is then subjected to 2 to 10, preferably 5 cycles of optional heat treatment and subsequent cooling cycles of temperatures" between 100° and 500°, preferably between 200° and 350°, most preferably between 250° and 300° F., for a period of from 30 minutes to 6 hours, preferably about 2 hours. The blend is finally cooled to room temperature, and any remaining ingredients, such as metallic peroxides, are mixed therewith. The viscosity of the resulting blend is lower when the temperature and pressure used are higher and when the heat cycles are longer.

The composition of the invention may be mixed with a fuel prior to or at the time of combustion in amounts of from 0.0001% to 10%, preferably from 0.005% to 5%, most preferably from 0.05% to 2% by weight of the fuel. In the case of a gasoline or diesel internal combustion engine, the mileage increases from 15% to 35%, while in a furnace or boiler, the fuel efficiency increases from 20% to 35%. The use of the composition in amounts above 10% does not significantly increase the energy harnessing rate. However, it still improves the pollution control and oxygen saving capabilities of the composition.

The mechanism by which the composition of the invention increases the energy harnessing rate is as follows: In high temperature flames the aforementioned organometallic cation produces P-N-P-N or N-P-N-P avalanche reactions releasing high energy ultraviolet radiation and electrons accelerated to high kinetic energy states. The high energy ultraviolet radiation ionizes the hydrogen atoms releasing accelerated high kinetic energy subatomic protons and electrons. These subatomic ions collide with each other and convert or "thermalize" this high kinetic energy into infrared heat energy. Thus, the high energy ultraviolet radiation is converted to useful infrared heat energy. The amount of released hydrogen energy can be controlled by either (1) proportioning the amount of a composition of the invention added to the hydrocarbon fuel. or (2) regulating the rate of fuel feed or other operational parameters of the internal or external combustion engine to control the flame temperature at which the catalytic ingredient is activated. In this way, with the use of a composition of the invention. the reflected and measured



New Energy Times Archive

efficiency of combustion of a hydrocarbon fuel can be increased dramatically by combining the non-oxidative released energy with ordinary oxidative combustion. These nonoxidative released energies are the result of the ionization of the hydrogen atom.

In addition. there are even higher levels of harnessable energy derived from the subatomic protons and electrons. When these ionized subatomic particles (plasmoids) produced by the ionization of hydrogen atoms come into close proximity, plasmoid fusion occurs. The resulting plasmoid energy is 1836 times as great as that produced by the ionization of a hydrogen atom alone. When the composition of the invention is added in a sufficient ratio to a hydrocarbon fuel in a highly elevated temperature environment, there is an exhibited collective behavior of the ionized protons and electrons. This collective behavior state occurs when said subatomic particles reach a density of 5% or higher. This collective behavior is called non-nuclear plasma fusion. The amount of energy released in this extremely high energy state is proportional to the level of fusion density.

Examples of the invention will be described below to illustrate the invention, and should not be construed as limiting its scope.

EXAMPLE I
Preparation of Catalyst Composition # 1

20% by weight of lithium stearate, 10% by weight of magnesium stearate, and 5% by weight of aluminum stearate (relative to the final composition) were placed in an autoclave which was filled with a helium gas. The autoclave was then heated to 425° F to melt the metallic carboxylic acid salts. The pressure was kept at 5 atm throughout the preparation. After the salts were melted, the temperature was adjusted to 325°F. 57% by weight of mineral and organic oils and 8% by weight of silicon-based synthetic oils (relative to the final composition) were added to the molten salts and the mixture was kept at this temperature for 3 hours. The blend was then subjected to 5 cycles of heat treatments between 100° and 360° F in a period of 2 hours. Finally, the blend was cooled to room temperature.

EXAMPLE 2
Preparation of Catalyst Composition #2

Catalyst #2 of the invention was prepared by repeating Example I except that the amounts of lithium. magnesium and aluminum stearates, and vehicle oils used were 16%, 8%, 44%, and 72% by weight, respectively.

EXAMPLE 3
Preparation of Catalyst Composition #3

Catalyst #3 of the invention was prepared by repeating Example I except that the amounts of lithium, magnesium and aluminum stearates, and vehicle oils used were 12%, 6%, 3%, and 79% by weight, respectively.

EXAMPLE 4
Preparation of Catalyst Composition #4

Catalyst #4 of the invention was prepared by repeating Example I except that only lithium stearate and a mineral oil were used, in amounts of 25% and 75% by weight, respectively.

EXAMPLE 5
Operation of Internal Combustion Gasoline Engine

A Ford car having a 302-CID, 4-cycle engine was used to make road tests of 10 round trips between Tappan Zee Bridge, NY, and Windsor Locks, CT, a distance of about 120 miles. The on-board instruments were calibrated to give maximum absolute errors of 0.001 mile and 0.001 gallon, respectively. Unleaded gasoline was used throughout the tests.

The first 5 round trips were made without using any catalyst of the invention. The resulting average fuel consumption was 8.28 gallons per 120 miles or 14.5 miles per gallon.

The second 5 round trips were made by adding Catalyst # I of the invention to the gasoline fuel in the catalyst-fuel ratio of 1:1000 by weight. Since the air-fuel ratio necessary for the optimal catalyzed fuel operation is lower than that of the straight fuel operation because of the physical hydrogen reaction occurring with the aid of the catalyst of the invention, the air-fuel ratio in the catalyzed fuel operation was reduced so that the chemical combustion conditions might be kept equal in both types of operation.

The resulting average fuel consumption was 6.3 gallons for 120 miles or 19.0 miles per gallon. This figure is 31% higher than that of the above base line operation.

EXAMPLE 6
Operation of Internal Combustion Gasoline Engine

Example 5 was repeated except that the catalyst used and the catalyst fuel-ratio were Catalyst #4 and 1:2560. respectively.

The resultant fuel consumptions were 6.5 gallons for 120 miles or 18.6 miles/gallon for the catalyzed fuel operation, which is 28.6% higher than the 14.5 miles/gallon for the straight fuel operation.

EXAMPLE 7
Operation of Internal Combustion Diesel Engine

Example 5 was repeated except that the test vehicle, the fuel, the catalyst and the catalyst-fuel ratio were a Volkswagen Rabbit Diesel having a 1.5-liter diesel engine. an aviation fuel "A "(cetane rating #50). Catalyst #2. and 1:1250. respectively.

The resultant fuel consumptions were 2.7 gallons for 120 miles or 45 miles/gallon for straight fuel operation and 2.1 gallons per 120 miles or 57 miles/gallon for the catalyzed fuel operation. which is 27% higher than that of the straight fuel operation.

EXAMPLE 8
Operation of Internal Combustion Diesel Engine

Example 5 was repeated except that the test vehicle, the fuel, the catalyst and the catalyst-fuel ratio were a GM Oldsmobile having a 350-CID diesel engine, a diesel fuel (cetane rating #40), Catalyst #2. and 1:1500, respectively.

The resultant fuel consumptions were 5.8 gallons for 120 miles or 20 miles/gallon for straight fuel operation and 4.7 gallons per 120 miles or 25 miles/gallon for the catalyzed fuel operation, which is 25% higher than that of the straight fuel operation.

EXAMPLE 9
Operation of Internal Combustion Diesel Engine

A 40-ton trailer truck operated on diesel fuel was used to make road tests of two round trips of 1000 miles each. The first round trip was made using only diesel fuel having a cetane number of 40. The first half of the 3 first round trip (500 miles) was run with a full load of 40 tons, while the return trip was performed with a half load. The second round trip was made in the same fashion using the same type of diesel fuel but mixed with Catalyst #2 of the invention at a catalyst-fuel ratio of 1:1500.

The resulting percent fuel savings for the operations with full and half loads were 22% and 17%, respectively.

The percent fuel saving was calculated as:

$$100x(G_1-G_2)G_1$$

where G_1 and G_2 are gallons of fuel used in the straight and catalyzed operations, respectively.

EXAMPLE 10
Operation of External Combustion Boiler

A boiler made by the Combustion Engineering Co. was used to conduct a series of tests. The boiler efficiency was defined as:

$$\text{Boiler efficiency } (\%)=100 \times S(Es - Efw)/(F \times H)$$

where S is the quantity of steam generated per hour, Es and Efw are the steam and feed water enthalpies, respectively, F is the quantity of fuel oil burned per hour, and H is the quantity of heat per gallon of the oil.

The boiler first was operated using #6 Fuel Oil without adding any catalyst of the invention. The average readings taken for various quantities during the operation were as follows:

Rate of steam generated: 22,000 lbs/hr

Steam temperature: 500°F
F.W. temperature: 186°F
Steam pressure: 175 psi
Heat rate of the oil: 145,000 BTU/gal

Boiler efficiency = 100 x 22.000(1270-154)/(249 x 145.000) = 68 (%)

Next, Catalyst #3 of the invention was injected into the burner manifold of the boiler at a catalyst-fuel rate of 1:2500, with the burner manifold recirculating valve closed. The rates of steam generated at 3 different rates of oil used were measured as shown in Table I.

TABLE 1

Level	Oil consumed	Steam generated	Flame temperature
1	185 gal/hr	19,700 lbs/hr	2100° F
2	205 gal/hr	23,300 lbs/hr	2300° F
3	260 gal/hr	30.400 lbs/hr	2700° F

The boiler efficiency at each level was calculated as:

B.E.1 = 100 x 19.7000(1270 - 154)/(185 x 145,000)=82 (%)
B.E.2 = 100 x 23.300(1270 - 154)/(205 x 145,000) = 87 (%)
B.E.3 = 100 x 30.400(1270 - 154)/(260 x 145,000) =90 (%)

From the above results it is apparent that the use of the catalyst of the invention made the boiler efficiency at each operational level 20%, 28%, and 32% higher than that of the base line operation. It is noted that the boiler was run at the third operational level for only a short period of time because it was loaded above normal operating level. Unfortunately, the boiler was incapable of achieving and maintaining flame temperatures of over 2800°. The above results, however, showed that as the flame temperature increased from about 2100° to 2700°, the boiler efficiency increased from 68% to 90%, indicating that the catalyst of the invention became more active at higher temperatures.

In both types of operations, a Hamilton 4-gas analyzer was installed to measure the quantities of oxygen, carbon dioxide, carbon monoxide, and unburned hydrocarbons in the stack gas. This gas analysis showed that the excess oxygen level in the catalyzed operation was only 1.5% to 2.5% in contrast to approximately 6% in the straight operation. The content of water vapor in the stack gas was substantially decreased in the catalyzed operation. This substantial decrease in stack water vapor is explained as follows. The hydrogen atom is oxidized to form water vapor during the normal chemical process known as combustion. However, when the composition of the invention is added to a hydrocarbon fuel in the proper ratio and above a certain minimum temperature, the hydrogen atom ionizes and is no longer available in its native state to combine with oxygen to form water vapor. In addition, a fireside inspection revealed that the hard deposits built up on the inac-

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cessible areas below the steam drum over years had gone. What was left in the other areas was also easily washed away with running water from a hose.

EXAMPLE I I

Torque Test with Internal Combustion Engine

A 327-CID Chevrolet engine with four barrel carburetor was installed on a dynamometer. First. six power pulls were made at around the factory specification point without using any catalyst of the invention. The measured torques are shown in Table 2.

TABLE 2

Pull	RPM	Torque	Corrected HP
1	4250	240	196
2	4000	265	204
3	4400	250	211
4	5000	196	187
5	4500	235	203
6	5300	170	177

The correction factor was 1.028 based on a dry bulb reading of 104° F, a wet bulb reading of 76° F, and a barometric reading of 30.54. During the test, the water temperature of the engine remained at 190° F, the oil temperature. read at one of the external filters' was also 190° and the oil pressure was 50 psi.

Then, the engine was brought to an idle, and one pint of Catalyst # 1 of the present invention was put into 20 gallons of gasoline in the tank. The engine was idled for five minutes to prime it with the catalyst. then 16 pulls were made. (The reason so many pulls made here is that the test operators were at first incredulous about the results, and every effort was made to find accurate figures.) A correction factor of 1.033 was used based on a dry bulb reading of 108° F., a wet bulb reading of 76° F, and a barometric reading of 30.55. The readings of torque are shown in Table 3.

TABLE 3

Pull	RPM	Torque	Corrected HP
1	4600	237	210
2	4600	248	224
3	4200	270	223
4	4100	280	226
5	4000	275	217
6	4600	250	226
7	4650	242	221
8	4000	275	217
9	4400	255	222
10	4600	243	221
11	4800	238	226
12	4050	278	222
13	4400	264	229
14	4800	237	225
15	4500	246	219
16	4700	239	222

During the test, the water and lubricating oil temperature were maintained at 190° F. The above data from Tables 2 and 3 can be combined to form Table 4 below.

From Table 4, it is evident that the average horsepower in the catalyzed operation is 10.0% to 27.5% higher (over the same range of operation) than without the composition of the invention being present in the fuel. FIG. 1 is a graph illustrating the above results more clearly.

TABLE 4

Engine RPM	HP Differential	% Gain
3000	36	27.5
3500	25	15.0
4000	21	11.0
4500	20	10.0
5000	43	23.0
5500	39	22.0

While the specific example of the invention have been described above, it is understood that various modifications or substitutions may be made in the above specific examples and therefore it is our intention that all such equivalents fail within the scope of the invention as recited in the following claims.

What is claimed is:

1. A composition of matter for harnessing the hydrogen energy of a hydrocarbon fuel, which comprises:

•10% to 90% by weight of a liposoluble organometallic salt of a fatty acid: and
•90% to 10% by weight of a vehicle oil, said organometallic salt being an organo metallic lithium salt.

2. A composition of matter as recited in claim 1, wherein said liposoluble organometallic salt consists of 7% to 60% by weight of an organometallic lithium salt and 3% to 30% by weight of an organometallic magnesium salt.

3. A composition of matter as recited in claim 1, wherein said liposoluble organometallic salt consists of 6% to 50% by weight of an organometallic lithium salt, 3% to 30% by weight of an organometallic aluminum salt.

4. A composition of matter as recited in claim 1, wherein said vehicle oil contains 0.1% to 12% by weight of a peroxide oxidant.

5. A process for preparing a hydrogen energy harnessing composition, which comprises the steps of:

•heating 10% to 90% by weight of an organometallic salt to temperatures between 50° and 800° F under pressures between one and 30 atm, for melting it; adjusting said temperature to between 250° and 500°;
•adding 90% to 10% by weight of a diluent oil to said organometallic compound to form a solution; keeping said solution at the same temperature for a period of from 5 minutes to 12 hours; and
•letting said solution stand to cool to room temperature.

6. A method of harnessing the hydrogen energy of a hydrocarbon fuel, which comprises the step of adding a catalyst composition comprising 10% to 90% by weight of a liposoluble organometallic lithium salt of a fatty acid and 90% to 10% of a vehicle oil to a fuel so that the percent of catalyst to fuel may be in the range of from 0.0001% to 10%o by weight.

Britz continued from page 49

the issue is as simple as the number of thermocouples in a cell, I think any scientist should be willing to accept a written comment from an expert or a schematic published in a conference proceedings. After I repeatedly sent Britz the message from Miles, he said he did not believe it because he does not trust me:

> You keep on about Miles; the only info I have "from" him comes through you, and you can undoubtedly understand why I don't regard that as trustworthy.

I cannot forge a message in the style of Melvin Miles. Britz does not need to trust me, he can contact Miles directly. Britz calls himself a skeptic, but he believes outlandish ideas when they let him deny reality. He will jump through hoops to avoid seeing those two humble thermocouples. I think he is scrambling to "maintain plausible deniability" as the politicians say – he knows they are real, but he wants an excuse to pretend they are not. He has rejected hundreds of quality papers for equally outlandish reasons.

A Fetish for Peer-review

I believe the peer-review system is a useful filter. It saves time for professionals, especially in established fields of science. Mistakes are winnowed out by the referees and authors. Peer-review can produce well rounded, dependable, error-free papers. Peer-review can have harmful effects too. It has been used to suppress controversial ideas. To a businessman from the freewheeling world of commerce, peer-review looks like a violation of the antitrust laws, suppression of free speech, and an invitation to politics and corruption. It gives established scientists a veto over younger researchers. I hate to think where the computer industry would be today if the conservative old-line designers at IBM could have prevented young upstarts from publishing articles and advertisements in *Byte* or *PC* magazine. I have no doubt that peer-review has been used to squelch many deserving cold fusion papers. Peer-review standards have been lax for anti-cold fusion papers by Jones and Morrison.

To get the full picture of a field like cold fusion, you need a balance of peer-reviewed and non-peer reviewed information. The paper is not enough. It is a condensation: years of work are abbreviated in five or six pages. You must ask the author for more details.

A peer reviewed paper is supposed to be a convenience, like a textbook. Britz treats it more like a Holy Writ. It has become an obsession, to the point where he will not accept a simple observation – the number of thermocouples in a cell! – unless it is approved by Higher Authorities. Britz uses peer-review as a blinder. It prevents him learning anything positive in support of a cold fusion paper. He has a double standard. He will use informal information and hearsay to find fault in a paper. Edmund Storms has recently been investigating thermal gradients in his

Britz continued on page 63

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Ken Shoulders' Electrum Validum

Edited by Robert Nelson

(Rex Research, P.O. Box 19250, Jean, NV 89019)

Kenneth R. Shoulders has received five US Patents for his discovery and development High Density Charge Cluster (HDCC) technology. Shoulders describes the HDCC entity as "a relatively discrete, self-contained, negatively charged, high density state of matter... [a bundle of electrons that] appears to be produced by the application of a high electrical field between a cathode and an anode." He has given it the name "Electrum Validum" (EV), meaning "strong electron", from the Greek "elektron" (electronic charge) and the Latin "valere" (to be strong, having power to unite).

Ken Shoulders suggests that EVs travel in an electromagnetic container, a potential well with a depth of about 2 kv. The electromagnetic field attracts a few ions, and they give the EV its mass. In a conventional electron beam, the containment is due to an external electrostatic or magnetic field, since electrons repel each other. Though an EV is a discrete bundle of electrons, it prefers to communicate with other objects, and disintegrates if it has nothing to do. An EV also can be conceived of as an atom without a nucleus, or as a spherical monopole oscillator. EVs exhibit soliton behavior with number densities equal to Avagadro's number. These non-neutral electron plasmoids contain various levels of binding energy which exceed that of atoms, and allows for new types of reactions with matter.

An EV is relatively small (about 0.1 micrometer) and has a high (-) electron charge (typically about 10^{11} electrons, minimally 10^{8} electrons). There is an upper limit of 1 (+) ion per 100,000 electrons. EVs attain a velocity on the order of one-tenth the speed of light under applied fields. Though the EV has a preferred quantum-level structure of approximately 1 micrometer diameter, EVs in the range of 1/10 micrometer diameter have been observed.

The EV probably is a spheroid, but it may toroidal and possess a fine structure. Lone EVs are rarely observed. They tend to form closed "chains" -- quasi-stable, ring-like structures as large as 20 micrometers in diameter (Fig. 1a, b). Although they are not vortexes or filaments, such rings can form chains of rings which are free to rotate and twist around each other. The spacing of EV beads in a chain is approximately equal to the diameter of the individual beads. EV chains appear to be tangled when they are launched from the cathode, but they automatically rearrange themselves into rings. Shoulders does "not mean to imply that there is an actual untwisting occurring, but rather that the nodes of a complex pattern are somehow moving." The EV chains hit a surface without rotation, translation or skewing.

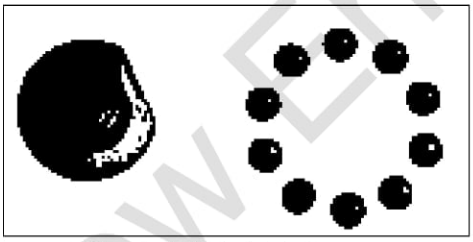

Figure 1: (a) EV & (b) EV Chain

EVs can be found in gross electrical discharges (lightning, sparks, etc.), but they are not practical in that form. Shoulders says, "The EV is formed and propagates to the anode whenever the DC or pulse voltage rises to the point at which field emission begins a runaway switching process aided by metallic vapor from the cathode emission site. This process happens 100% of the time." Shoulders' patents describe devices for propagating, isolating, selecting and manipulating EVs so that thermal energy, electrical power, and other work can be extracted from them. Their path can be switched or varied in length for use with a camera, oscilloscope, or panel display. Shoulders' EV devices have properties superior to any other technology.

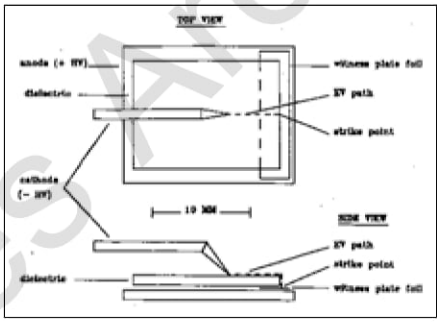

Figure 2: EV Generator

Another patent is pending for the remediation of nuclear waste by EVs. This is a priceless application of this technology; it will be the basis of a great new industry of inestimable value to humanity and the planet.

An EV can be generated at the tip of a sharply pointed electrode when a large negative charge (2-10 kv) is applied. A dielectric plate (preferably fused quartz or alumina, typically 0.0254 cm thick) intervenes between the emitter cathode and the collector anode.(Figs. 2, 3)

The EV makes a streak of light as it travels across the surface of the dielectric, and imparts a localized surface charge. Unless this charge is dispersed, it will cause the next EV to follow another path. A witness plate of metal foil may be positioned to intercept the EVs, and will sustain visible damage from their impact. The foil thus serves to detect and locate the entities even if they are invisible ("black EVs").

The anode current value can vary from 1 to 6 amperes. Shoulders has found that a 1-ampere level of anode current is produced by a chain of 3-5 EV beads whose overall diameter is about 3 micrometers. A sufficiently low load resistor must be used so that the voltage will not rise and deflect the EV. For a 2 kv pulse, a rise of 500 volts at the anode is a reasonable maximum. The rise rate is very high, and a wide-band oscilloscope is required to measure it. Otherwise, a capacity load must be provided for the EV. There is an upper EV size or current limit that can be collected for any particular wire size.

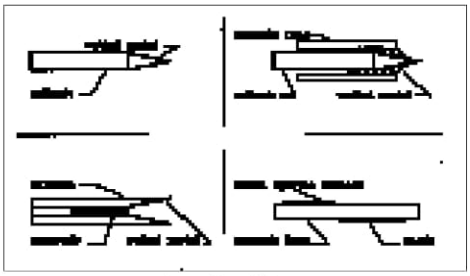

Figure 3: EV Sources

The EV generator is typically about 10 mm. long, but the generation and manipulation of EVs can be accomplished with

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structures as small as 10 micrometers. The materials used in its construction need be very stable and durable to withstand the high energy of EVs. The generator also can be tubular, and it can be designed to operate in a vacuum or in a gaseous atmosphere. In a high vacuum system, the space between the cathode and anode should be less than 1 mm for a 2 kv charge. In a gaseous atmosphere of a few torrs pressure, the distance between the electrodes can extend to over 60 cm if a ground plane is positioned next to or around the tube.

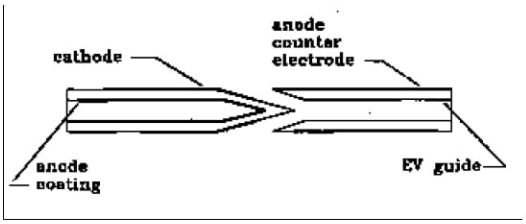

Figure 4: EV Launcher

The negative pulse can vary from a few nanoseconds to continuous DC without unduly influencing the production of EVs. A series resistor is placed between the pulse voltage source and the EV generator, and a scope is used to monitor the voltage. The current is calculated from the resistor value and the voltage drop. Long pulse conditions in a gas atmosphere require the use of an input resistor to prevent a sustained glow discharge within the tube. The discharge is easily quenched under low pressure or vacuum conditions. Using a pulse period of 0.1 microsecond, for example, a resistor value of 500 to 1500 ohms is practical for operation in either a vacuum or gaseous regime.

The formation of an EV is a very fast event which cannot be observed clearly on a conventional oscilloscope; all that shows is a disturbance and a small step for a few nanoseconds. Ken Shoulders has developed a "picoscope" which performs as an oscilloscope for waveform measurements in real time to 10^{-13} seconds.

The cathode may be constructed of copper or a wide variety of other materials (Ag, Ni, Al, etc.). It must have a sharp tip or edge so that a very high field can concentrate there. However, the dissipation of energy by EV production destroys the electrode tip, which must be regenerated. This can be accomplished with a liquid conductor such as mercury. Non-metal conductors also may be used instead (i.e., glycerin doped with potassium iodide, or nitroglycerin/nitric acid). The pulse rate of the power applied to the cathode must be low enough to allow migration of the liquid conductor.

The cathode also can be embedded within a guide groove in the dielectric base. Such a cathode may be made of metallic paste fired into an alumina base. Molybdenum is preferable because silver or copper are too soluble in mercury to be useful in such a film circuit. A surface embedded cathode enables the propagation of EVs with only 500 volts and a much higher pulse rate.

EVs may be launched across a gap between the cathode and dielectric guide if the end of the cathode forms an acute angle. In a low-pressure atmosphere (*i.e*, Hg or Xe at 10^{-2} torr), an EV launcher can be operated with a cathode pulse as low as 200 volts. If the dimensions of the components are reduced to a minimum (*i.e.*, 1 micrometer thickness of the dielectric base), an EV can be launched with less than 100 volts difference between the cathode and anode. (Fig. 4)

The operation of a wetted cathode produces vaporous products which form a (+) ion cloud and enhance the production of EVs. However, these vapors are considered as contaminants which must be stripped away from the EVs. This is done by a tunnel dielectric separator which contain the contaminants while the EVs exit toward the collector anode. The separator is provided with a counterelectrode located on the exterior of the tunnel and maintained at a positive potential relative to the cathode. The anode is positively charged relative to the counterelectrode. Typical voltage values are in the range of 4 kv on the cathode, 2 kv on the counter-electrode, and 0 on the anode. If the separator tunnel is constructed of semiconductor material, the tunnel itself can serve as a counter-electrode.

"Energy available at the output of the helix of the traveling wave tube is 96 times the energy input to the traveling wave tube, in addition to the energy consumed within the traveling wave tube and the energy available in the form of collected particles at the collector electrode."

EVs tend to follow fine structural details such as surface scratches and imperfections. Thus, EVs can be guided by providing a smooth groove or an intersection of two dielectric surfaces or planes at an angle less than 180°. The groove needs be only a few micrometers wide and deep. The guiding effect may be enhanced by a tubular dielectric guide provided with an exterior counterelectrode or ground plane. The guide channel can be as small as 20 micrometers in diameter without restricting the EVs. If an EV is larger than the channel, it will bore out a wider pathway for itself. Once this is done, no further damage will be done by subsequent EVs. As EVs travel across a dielectric surface, they seem to synchronize their paths in a 180° out-of-phase relationship.

An EV can be guided across the surface of a dielectric if a positively charged ground plane or counterelectrode is positioned on the opposite side of the dielectric. The path of the EV also can be influenced by RC (Resistance/Capacitance) and LC (Induction/ Capacitance) guides.

A gaseous environment can be used to enhance the guidance of EVs. Mercury and xenon work particularly well. In a low pressure atmosphere (typically 10^{-3} to 10^{-2} torr), the EV chain rises slightly from the dielectric surface and no longer interacts disruptively with it. The efficiency of transmission is increased accordingly, and the EVs can travel further between electrodes. Surface charge effects dissipate after an EV is propagated in a gaseous environment. If the unit is pulsed without any gas in the channel and the anode is at an excessive distance for the applied voltage, no EVs are formed. This condition is called "flaring". (Fig. 5)

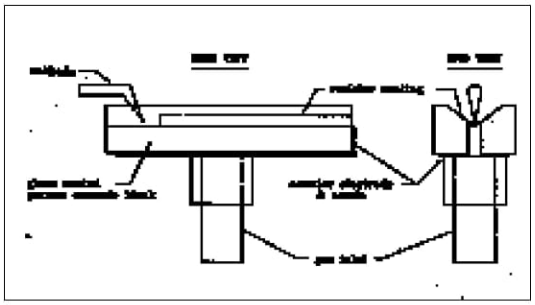
Figure 5: Gas EV Guide

At higher atmospheres, the EVs lift further from the dielectric surface and are cushioned from it by the gas guide. The groove

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guide and counterelectrode create a wedge-shaped gas pressure gradient which helps guide the EVs. In addition, the interior of the groove can be given a coating of resistor material to provide surface charge suppression.

When an EV moves through an atmosphere without RC guidance, it is accompanied by a visible streamer. A narrow beam of light appears to precede the streamer, possibly due to ionization of gas by the streamer. This forward light beam can be deflected by objects, and the EV and its streamer will follow it. This property makes possible the use of optical mirror guides for EVs. The mirrors should be constructed of material with a high dielectric constant and good reflectivity in the ultraviolet region. They need be only a few micrometers on a side.

When an EV ap-proaches any circuit element, it depresses the potential of that element, which then becomes less attractive to the EV. Inductive elements are very susceptible to this effect and can be used to provide an LC guide for EVs. LC guides can be made in a variety of shapes, such as laminar planar designs or quadripoles which operate without the need of producing image forces. The poles should be quarter wave structures at the approach frequency of the EV; this is determined by the speed of the EV and its distance from the pole elements. They should be at least 20 micrometers apart and enclosed with conductive shields. (Fig. 6)

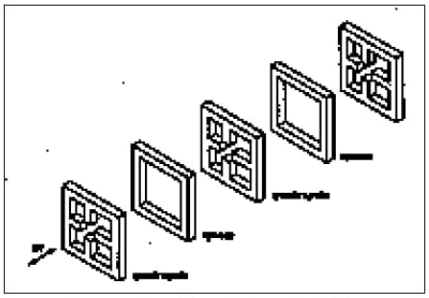

Figure 6: Quadrupole LC EV Guide

If an EV crosses a rough surface, it loses electrons which produce a surface charge that retards subsequent EVs. The surface charge can be suppressed in several ways. The dielectric base can be coated with alumina doped with chromium, tungsten or molybdenum to provide bulk conductivity to the substrate. The resistance must not be less than 200 ohms per square inch. The effect can be enhanced by decreasing the thickness of the substrate. The surface charge also can be removed by photoconductive processes if the dielectric is composed of diamond carbon doped with graphite. Another method is bombardment-induced conductivity, activated by the high-speed electrons from EVs.

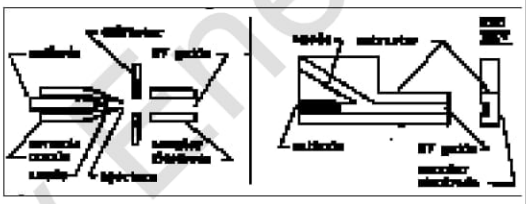

Figure 7: EV Selectors

Beads of EVs can be isolated from their chains for use in a process or device. Approximately 5 EV chains, each containing 1-12 beads, can be extracted from a total charge by a selector device provided with an extractor electrode that is positively charged with about 2 kv. A series of EV separators permits extraction of EVs of a specific binding energy from a multitude of chains with a wide range of binding energies. (Figs. 7-9)

A large burst of EVs can be divided by a splitter apparatus into many closely timed or synchronized sub-events. An EV splitter is constructed by interrupting a guide device with narrow secondary channels which intersect the main guide channel at positions where the EVs propagate. A single EV can be expected to turn into a side channel in each event, but the crowding effect of multiple EVs prevents the total group from diverting into a splitter. Multiple EVs generated by a single pulse may be split up to produce EV arrival signals at two or more locations, either simultaneously or with variable time delays. The guide components may include turns which selectively change the direction of EV propagation.

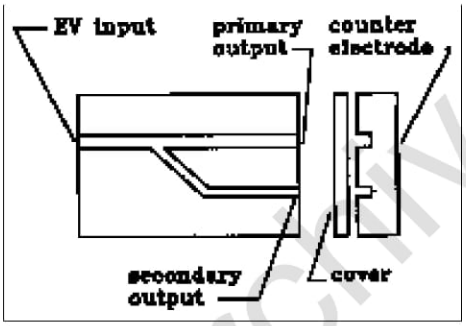

Figure 8: EV Splitters

The direction of EV travel also can be influenced by transverse electric fields. The extent of deflection depends on the size of the deflecting field and its time period.. The deflecting field can be turned on/off or varied in strength to provide selective deflection. The deflection switch must not be near any guide channel which would interfere with transverse deflection of EVs. Degenerative or regenerative voltage feedback from the passing EVs can be used to communicate with a deflection switch by a push-pull device or filter. The deflection voltage can be as low as a few tens of volts. Deflection switching can be used to design multi-electrode sources (triodes, tetrodes, etc.). In general, techniques used in the operation of vacuum tubes can be applied to EV devices.

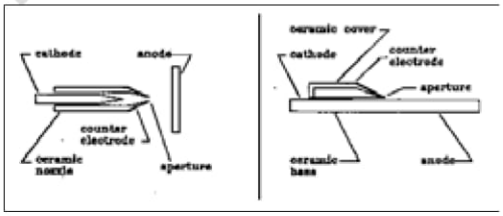

Figure 9: EV Separators

The use of field-forming structures such as deflection electrodes make possible the construction of an EV oscilloscope with a phosphor screen, optical microscope, or electron (video) camera. Accordingly, single event waveforms in the 0.1 picosecond range can be observed with a "picoscope" embedded in the EV generator. (Fig. 10)

EVs also can be generated in "electrodeless" devices which use radio frequency energy to stimulate a gas (preferably xenon) at 0.1 atmosphere pressure. External metallic electrodes are excited with approximately 3 kv which is transmitted through a tubular or planar dielectric envelope to a formation chamber which acts as a "virtual cathode." A counterelectrode ground plane cannot completely circumscribe such an envelope, because it would prevent the electromagnetic radiation signal from propagating out of the tube. A wire helix is used, terminating in an impedance-matched load. (Fig. 11)

For example, if a 30 cm helix with a delay of approximately 16 nanoseconds at 200 ohms impedance is wrapped around a tube with an outside diameter of 3 mm (1 mm. i.d., 10^{-2} Xe atmosphere), an EV can be launched with a 1 kv source at a rate of 100 pulses/second through a 1500 ohm input resistor, with an anode voltage of zero and a target load of 50 ohms to achieve an output voltage of -2 kv on a 200 ohm delay line and an output voltage of -60 volts at the target. The waveform generated in the helix is a function of the gas pressure. Using these parameters, a sharp negative pulse (16 ns long) was produced, followed by a flat pulse that was linearly related to the gas pressure. At mini-

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mal gas pressure, the flat pulse can be eliminated.

The propagation of EVs through a gas atmosphere produces

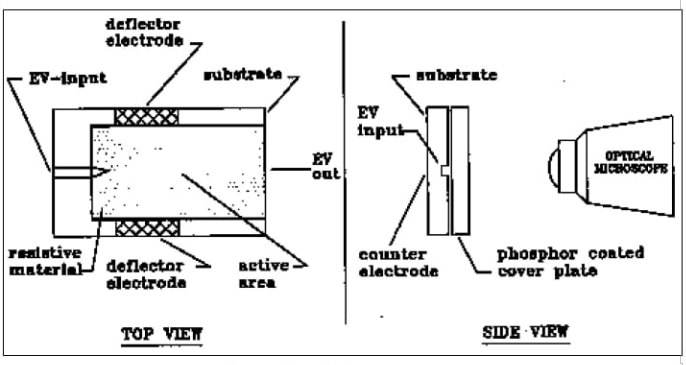

Figure 10: EV Picoscope

very thin, bright ion streamers in the gas or along the wall of the envelope. In an electrodeless device, other EVs may follow along the same sheath of an ion streamer formed by a preceding EV. The thickness of the ion sheath increases as multiple EVs propagate along the same streamer. If the gas pressure is very low, EVs will propagate without the formation of a visible streamer. Such are known as "black" EVs.

The EVs generated within an electrodeless envelope can be used in a traveling wave tube. Such devices provides good coupling with a conventional electrical circuit and can exchange energy with it. Electromagnetic radiation from microwaves to visible light frequencies can be generated by EV pulses and coupled to an electrical circuit by adjusting the parameters of the transmission line and the EV generation energy. (Fig. 12)

The generation of EVs requires the rapid concentration of a very high, uncompensated electronic charge in a small volume. The previously described field emission processes produce metal vapors from the cathode by thermal evaporation and ionic bombardment. Pure field emission generation of EVs can be accomplished with fast switching in a high vacuum environment. The emission process must be switched on/off before the emitter overheats and evaporates; that is, faster than the thermal time constant of the cathode (typically less than 1 picosecond). The field emitter has critical limiting size of approximately 1 micrometer lateral dimension. Larger cathodes suffer undue thermal strain, whereas "below the one micrometer size range, the field emitter has the advantage of large cooling effects provided by small elements having a naturally high surface-to-volume ratio."

The emitter can have a positive bias if it is over 2 kv; the electrodes are spaced about 1 mm apart. The extractor electrode must be coated with a resistor material (approximately 10^{-2} to 10^{-6} ohms).

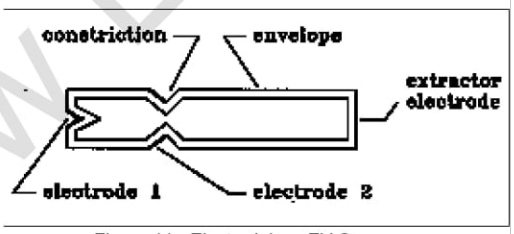

Figure 11: Electrodeless EV Source

Ken Shoulders' has also built a "picopulser" to control the generation of EVs in less than a picosecond. (Fig. 13)

If an EV is destroyed completely, X-rays ae produced. When an EV is caught in a low-inductance circuit, it releases its energy so rapidly as to produce X-ray photons with about 2 kv of energy. The EV impact also can produce thermionic pulse emissions and phenomena --- most notably, atomic transmutations. (Fig. 14)

EVs can be used as an electron source. Secondary emission of electrons from passing EVs can be collected out the top of the RC guide groove, but there is a relatively long time constant for recharge. LC guides have a much faster recharge rate and can be used to generate radio frequencies.

According to Shoulders, "There is a reciprocal relationship between the EV velocity along the channel guide and the output cavities, in conjunction with the collector electrode arms, that determines the frequency of the radiation provided. The frequency produced is equal to the speed of the EV multiplied by the inverse of the spacing between the slots... The shapes of the openings in the counterelectrode determine the wave forms to be produced. Aperiodic waveforms, which may be employed for driving various computer or timing functions, can be generated... by appropriately shaping the counterelectrode openings... The load on the collector electrode must be proportioned according to the bandwidth of the generated waveform."

Figure 12: EV Coupling to Traveling Wave Circuits

LC guide structures also can be shaped as "wigglers" or circulators. A charge under acceleration radiates energy at a frequency which is determined by the acceleration of the charge. Intensity varies in relation to "the geometry of the radiation source and the number of charges involved. Thus a radiation source can be produced by a slowly moving charge in a small radius or a fast moving charge in a large radius. The time for one complete circulation defines the frequency. Furthermore, the radiation pattern from a circulating charge is equivalent to two lines of charges oscillating in a sinusoidal manner with a phase angle of 90° to each other." Harmonic radiators, phased array antennas, etc., also can be utilized.

LRC (Inductance/Resistance/Capacitance) resonant guide circuits can be designed for many applications; *i.e.*, to improve the recharge time constant without necessitating doping of the dielectric material. Stray charges are removed by a thin metal coating on the walls of the guide. According to Shoulders, "The coating would optimally be in the range of 200-500 angstroms, where good optical reflectance is obtained for the EV, but where the resistance along the channel is moderately high. Aluminum and molybdenum are good classes of materials for coating the guide... [Fig. 15]

"The circulators and the wiggler type of radiators... are directly applicable to a wide range of collision avoidance and communications applications where the generator array is directly exposed to the environment being radiated... By using EV circulators having... a frequency of 3 GHz (a wavelength of 10 cm), this entails the use of a circulator having a physical dimension of 3 cm for light velocity circulation or 4.3 cm for 1/10 light

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velocity EVs. These radiators... can be placed in an array of thousands laid out on a plane substrate of only a few inches on a side... For a pulse system, they have to be turned on at different times as well as phase controlled. This is a complex switching pattern for thousands of sources, but it is within the capability of an EV switching system to do this..."

A phenomenon occurs when dealing with EVs that is not available when using conventional wiring methods. Crossed guides can be established at 90° to each other (on XYZ axes) without the effect of "shorting" that would occur in a wired circuit.

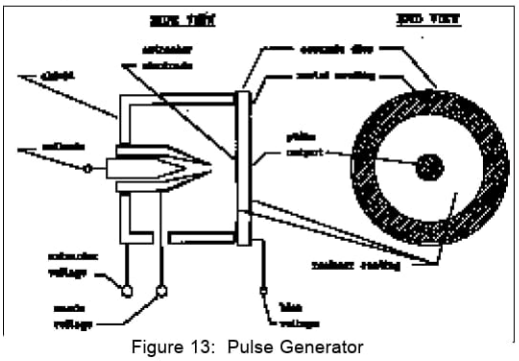

Figure 13: Pulse Generator

The passage of an EV along a traveling wave tube or planar device results in sudden accumulation of negative charge yielding direct current at the collector electrode. Under optimal conditions, the output of the device exceeds that necessary to generate the EV. Shoulders offers, "For example... an input pulse of 1 kv through the input resistor of 1500 ohms, and an output pulse of 2 kv through the helix having an impedance of 200 ohms, the ratio of the output peak power to the input peak power is 20,000 /667 = 30. This result must be multiplied by the ratio of the width of the output pulse to the input pulse width, which was given as 16 ns (600 ns = 0.027. The resulting corrected energy conversion factor is 0.027 x 30 - 0.81... A portion of the input energy is lost to excitation of the gas in the traveling wave tube...

"Under preferred conditions, the gas pressure is reduced to the lowest value that will sustain the EV generation... With the input pulse length reduced to 5 ns for example, the corrected energy conversion factor becomes (16 / 5) /30 = 96. That is to say, with the input pulse lengths reduced as noted, energy available at the output of the helix of the traveling wave tube is 96 times the energy input to the traveling wave tube, in addition to the energy consumed within the traveling wave tube and the energy available in the form of collected particles at the collector electrode.

"Even a greater energy conversion factor is available if the input pulse is further reduced; an EV may be generated with an input pulse as short as 10^{-3} ns. The EV is a mechanism for tapping a source of energy [probably the zero-point] and providing that energy for conversion to usable electrical form... I believe a large portion of the electron charges contained within an EV are masked, so that... the EV does not manifest to external measuring devices a charge size equal to the total charge contained within an EV."

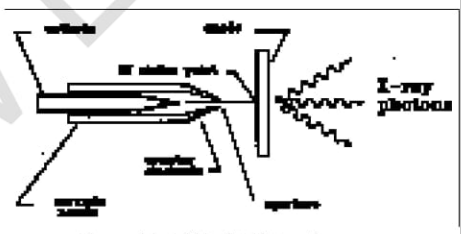

Figure 14: EV Point X-Ray Source

The residual charge carried by a 3-micrometer EV striking an electrode is 2 x 10^{10} electrons. As many as 3.5 x 10^{14} electrons can be shed by a 10-micrometer EV while traveling 1 mm. There are some indications that an EV may explode once it reaches a critical lower charge or density.

Shoulders has calculated that the current density of an EV is about 6 x 10^{11} amps/cm^3. Its rate of emission would be approximately 1.7 x 10^6 amps. The lifetime of an EV is approximately 3 x 10^{-11} second. His calculations show the charge density to be about 6.6 x 10^{23} electrons/cm^3 , which approximates that of a solid.

Shoulders claims that "At this point I can fall back on the paper of Bergstrom... and claim that the motion of contained charges is indeed what binds them to the remaining charges forming the entity. At this same juncture, I can step over into the holy region of the vacuum, or polarizable ether, as Bergstrom called it, and begin to look for the sustaining process that keeps the entity intact for longer than it would seem possible from initial energy input considerations. I will invoke zero point fluctuations as the ubiquitous energy source to sustain the life of the EV... I claim that the initial motion of electrons set up at the time of an EV formation is kept in equilibrium or compressed further by the electromagnetic input from the zero-point fluctuations...

"Since the ZPF energy supply rate is limited (probably by coupling considerations) there is a finite extraction rate of energy from the electrons in the potential well created, before the stability criterion for the well is exceeded. If this rate is exceeded, as it may well be upon contact between an EV and a metal, then the EV explodes, giving up its container energy into whatever region of the radiation spectrum is most appropriate. There are indications that this may be the soft x-ray region for 1 micrometer beads... The constant diameter of bored holes [in aluminum oxide] suggests that the device doing the boring was either very high in energy content, and hardly affected by the operation, or that it was being resupplied with energy as it went. I choose the latter explanation..."

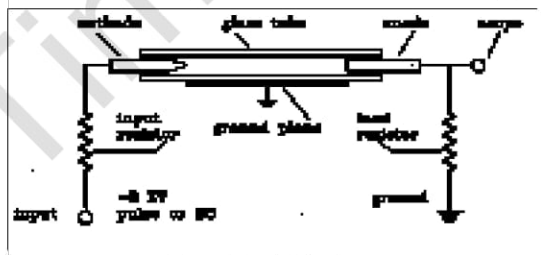

Figure 15: EV Circuit

Ken Shoulders also has suggested that the EV is a spherical monopole oscillator. As he describes it in the conclusion of his book *EV: A Tale of Discovery*, "This [monopole oscillator] is the perfect generator for vector and scalar potential waves without contamination from either E or B fields. These waves can be thought of as longitudinal waves in the vacuum. They are largely undetectable by standard E and B detecting means but are readily accessible to the monopole world. There appears to be an incredibly large number of useful phenomena yet to arise from using potential effects that are not immediately accessible to the force of E and B fields. This phase determined, force-free world will certainly be another chapter somewhere in the future" of EV research and development.

One of the most important applications of EV technology will be in the treatment of nuclear waste, which can be transmuted by EVs into non-radioactive elements. Shoulders has a patent pending on the process, which is called **Plasma-Injected Transmutation**. Other researchers (Rod Neal, Stan Gleason, et al.) also have filed for patents on similar applications. EVs apparently function as a collective accelerator with sufficient

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energy to inject a large group of nuclei into a target and promote nuclear cluster reactions. The composition of EVs allows for the inclusion of some 10^5 nuclides. Ions can be added to EVs until the net charge becomes positive. Such EVs are called NEVs (Nuclide-EVs). According to Shoulders, "The NEV acts as an ultra-massive, negative ion with high charge-to-mass ratio. This provides the function of a simple nuclear accelerator." NEVs can be produced by mechanical energy which is stored in and stored released from a brittle metal lattice by fracto-emission of electrons. In the case of acoustic/aqueous systems, they are generated by charge separation in a collapsing bubble. Analysis of palladium foils after they were struck by NEVs has revealed increased quantities of Mg, Ca, Si, Ga and Au. Locally produced fracto-emission induced by NEV strikes contribute a considerable amount of energy to the reactions and can initiate a "wildfire" propagation of energy which either triggers or fuels the events.

Shoulders concludes that "such nuclear reactions are fundamentally an event involving large numbers and not one of widely isolated events working at an atomic level." These events occur within a few tenths of a picosecond. The first step is a loading process process that renders the material brittle. Then a very rapid fracture generates a NEV, compression-loaded with available nucleons (*i.e.*, 100,000 deuterons in an electrolytic cold fusion cell). The NEV is accelerated into the parent material by the applied voltage which, though it is only in the kilovolt range, has a velocity equivalent to megavolts due to the mechanism of the accleration in the fracture. Shoulders offers an *ad hoc* explanation of these results as being "due largely to a nuclear cluster reaction having an unknown form of coherence."

Ken Shoulders has demonstrated the complete elimination of radioactivity in high-level nuclear material. Whatever the mechanism may be, the neutralization of our huge stores of radioactive waste by EV technology will be a great wonderment and blessing, for which we can thank Ken Shoulders.

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Britz continued from page 57

own cell. Britz heard about this informally. In our debate, Britz ignored what Miles wrote about an actual IMRA cell, but he kept cited statements Storms has made about a non-IMRA cell. This is unpublished work-in-progress, performed in Ed's basement. It is as far from peer-reviewed information as you can get.

In the on-line data base, Britz describes McKubre's *J. Electroanalytical Chemistry* paper:

> Thought by many to be one of the most thorough studies in this area, and long delayed in publication, this paper at last reports the results. A quality isothermal flow calorimeter was used here, and D/Pd (or H/Pd) loadings were monitored in situ by resistance measurements. . . . Excess powers were observed only for D/Pd above 0.9 and reached 28% input power, but were typically about 5-10%, with the noise lying at about 1/20 the excess power level. . . .

This is a fair summary, and true as far as it goes. The wording is a little misleading. "Noise lying at about 1/20 the excess power" sounds as if the noise is 5% at any power level. Actually, in a conservative analysis it is ~5% of the low heat, but only a few percent of high heat.

In a larger sense this review ignores critical aspects McKubre's work. The paper was submitted in 1993. McKubre subsequently observed higher excess heat with improved calorimeters at a higher signal to noise ratio. These newer results have not been published in a peer reviewed journal, so Britz does not mention them. For example, in experiment P19 McKubre reported excess power of: "500% of I*Vcell for more than one day, and more than 200% of I*Vcell for another three days." (He concludes, "The effect is thus neither small nor fleeting.") This comes from the official EPRI report on McKubre's work.[7] While it is not peer-reviewed, it is authoritative and I think anyone seriously interested in this field should read it. I think that McKubre has been unable to publish additional papers because of the widespread hostility toward cold fusion, so it is unfair to exclude his work after 1993. Britz says he is upholding high standards by listing only peer reviewed work, but I think he goes too far. His readers will get the impression that McKubre has not seen anything more convincing than 28% excess.

Britz refuses to look at Claytor's famous tritium paper because it has not been published in a peer-reviewed journal. Claytor's project has survived the Los Alamos internal peer review many times, against hostile opposition. Storms says this process is more rigorous than most journal reviews. Claytor's paper is the best proof of tritium since Will. Claytor faces stiff political opposition to his research within Los Alamos. He has sometimes not been allowed to attend conferences to lecture on his work, so I do not think he would be allowed to submit a paper to a journal. Most journals would reject it out of hand in any case. Perhaps Britz can make a case for upholding his rigid standards by not including this paper in his data base, but he should at least read it. He says:

> This is not in my bibliography, probably either because it hasn't been published in a real journal, or I haven't seen a reference to such a publication yet. If it gets published, I will see it and add it. But I don't take Reports.

He sometimes begs off, saying he does not have time to chase down obscure papers because the data base is only a part-time hobby. Yet the Claytor report is on Internet, at *http://www.nde.esa.lanl.gov/cf/tritweb.htm*, where anyone can access it in three minutes.

Compartmentalization and Other Peculiar Mental Habits

In our debate over thermal gradients, Britz started out by insisting that the discussion be limited to only one paper from

Britz continued on page 69

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Part III of a New Section for an old subject that is now being revisited in cold fusion and transmutation laboratories around the world.....
(See *Infinite Energy* Issues #15/16 & 17 for Part I and II)

ALCHEMY – HISTORICAL REPORTS

The Transmutation of Mercury to Gold

by Robert Nelson
(Rex Research, P.O. Box 19250, Jean, NV 89019)

In March 1924, Prof. Hantaro Nagaoka, *et al.* (Tokyo Imperial University), described their studies "on the isotopes of mercury and bismuth revealed in the satellites of their spectral lines" --- gold in particular. In May 1925, they reported some of the technical details: Nagaoka and his co-workers discharged about 15 x 10^4 volts/cm for 4 hours between tungsten and mercury terminal under a dielectric layer of paraffin oil. They used the Purple of Cassius test to detect Au in the viscous residue of C, Hg, etc. The black mass was purified in vacuo, then by combustion with oxygen and extraction with HCl to yield Au, either in aqua regia solution or as ruby-red spots in the glassware. Microscopic films of Au were found on occasion. (19, 22)

Nagaoka stated that when a discharge was passed through drops of Hg falling between iron electrodes, the formation of silver and other elements was observed. Another run of a Hg lamp for more than 200 hours at 226 volts produced a milligram of gold, plus some platinum. It was noted that, "In order to be sure of transmutation, repeated purification of Hg by distilling in vacuum at temperatures below 200° C. is essential." Considerations of the satellites of the spectral lines of Hg led Nagaoka to the conclusion that a proton is "slightly detached" from the nucleus of Hg, and it can be removed. It was surmised that "if the above assumption as to the Hg nucleus is valid, we can perhaps realize the dream of alchemists by striking out a hydrogen-proton from the nucleus by α-rays, or by some other powerful methods of disruption" to produce Au from Hg. (21, 26)

At about the same time, Professor Adolf Miethe of the Photochemical Department at the Berlin Technical High School found that the mercury vapor lamps used as a source for ultraviolet rays ceased to work after a time because of a sooty deposit which formed in the quartz tubes. Miethe tested these deposits and detected gold. Subsequently, Dr. Miethe and Dr. Hans Stammreich were issued German Patent Specification #233,715 (8 May 1924) for "Improvements in or Relating to the Extraction of Precious Metals." (12)

According to the specification, "an electric arc is formed between mercury poles, in the same way as is done in mercury quartz lamps. With sufficient difference in potential, gold is then produced in the mercury. It is advisable to condense again the evaporated mercury. The quantity of gold produced depends, all other conditions being equal, on the quantity of current and also, among others, on the vapor pressure of the mercury or on the difference of potential in the arc. The difference of potential in the arc must therefore be sufficiently great. If it drops to excessively small amounts, the efficiency will be greatly reduced. If the difference of potential is increased, the quantity of gold formed will be considerably increased, beginning with a certain difference of potential."

In July of 1924, Dr. Miethe announced that he and Dr. Stammreich had changed mercury into gold in a high-tension mercury vapor lamp. The experiment produced $1 of gold at a cost of $60,000, equivalent to over $2 million today (gold then sold for $330/lb) (12).

Miethe used a potential of 170 volts applied for 20-200 hours. The lamp consumed 400-2,000 watts. A minimum potential difference is necessary. The yield of gold was minute: 0.1-0.01 mg. The mercury and the electrodes were analyzed and determined to be free of gold before the experiments. Miethe was not able to attempt to prove the production of α or β rays, hydrogen or helium. (22)

O. Honigschmid and E. Zintl determined the atomic weight of Miethe's mercuric Au, using potentiometric titration of auric salt with $TiCl_2$. It was found to be 197.26 (± 0.2), which is heavier than ordinary Au (197.2). They emphasized the need for a mass spectral analysis. (10)

Frederick Soddy responded to the announcement of Miethe's claims with the suggestion that such a change might be effected by attaching an electron to the mercury nucleus: "Consider the collision of high-speed electrons with mercury atoms. A small proportion of these electrons must be directed upon the nucleus. If they possess sufficient energy to penetrate the external levels of electrons in the mercury atom, they must reach the positively charged nucleus and be captured by it. Since the loss of an electron (as a β-ray) by the nucleus of an element results in the atomic number of the element in question being increased by one, the gain of an electron by an atomic nucleus must result in the diminution of the atomic number by one. This is quite general. In the case of an isotope of mercury of atomic number 80, the product will be an isotope of gold of atomic number 79. Upon existing knowledge it is simply a question of (1) the potential sufficient to drive the electron through the outer levels of electrons surrounding the mercury nucleus until it comes within the sphere of attraction of the powerfully charged nucleus; (2) whether the exceedingly small fraction of direct collisions with the nucleus that is to be anticipated will be sufficient to enable the gold produced to be detected.

"As regards the first, it may be expected that the repulsion of the external shell of mercury electrons will diminish rather than prevent altogether the chance of the radiant electron reaching the nucleus; for once the shell is penetrated, the resultant force on the radiant electron must be on the average an attraction... The chemical detection of the gold produced would probably be the more formidable experimental difficulty. (30)

In the opinion of A.S. Russell, "The experiments on the transformation of Hg into Au suggest the possibility of the transformation of a nucleus into that of the element next below it by the absorption of one electron when both nuclei are stable. This occurs most obviously as an isobare. The possibility of the existence of two isobares of odd mass-number, Tl 205 and Au 199,

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among non-radioactive elements may be inferred from experimental work... Aston has shown the existence of the Hg isotope 199... This type of transformation may occur in the two pairs of elements Pb and Tl, Hg and Au... The masses of the Tl and Au produced are 205 and 199 respectively."

Aston advanced strong arguments against the probability of the alleged Hg-Au transmutation. Conceivably it could be effected by the addition of an electron to the nucleus of Hg, or by removing a proton from it, but the chance of an electron hitting a nucleus is extremely remote, and its weight would not make a significant contribution. Theoretically, a Hg isotope of atomic weight 197 could absorb an electron and produce common Au, but none of the six Hg isotopes (198, 199, 201, 202, 204, 209) identified by Aston have that weight. According to Aston, the removal of a proton from the nucleus by Miethe's method is untenable; "The forces employed are ludicruously inadequate." (1, 22)

"It is to be freely admitted, of course, that a transmutation of mercury atoms into gold atoms is a theoretical possibility"

The process can be shown as:

Hg - α – θ = Au
At. wt. 201 - 4 = 197
80 - 2 + 1 = 79, or:
Hg - 4H - 3θ = Au
At. wt. 201 - 4 = 197
80 – 4 + 3 = 79

In December 1924, the journal *Scientific American* announced that it would arrange for a comprehensive and exact test of the Miethe experiment. It was conducted by the Department of Physics at New York University by Prof. H.H. Sheldon and Roger Estey. They used a quartz lamp which contained no gold, and pure tungsten wires were sealed into the quartz to provide electrical contacts. The mercury was tested for purity. Three runs were made lasting from 30-50 hours each, at about 170 volts/13 amperes. The mercury was removed and tested:

"In no instance was any trace of gold detected... According to Prof. Miethe's reports, taken in connection with the theoretical interpretation of Prof. Soddy, this experiment should have produced a substantial quantity of gold; at least ten times as much as could easily have been detected by the analytical methods used. The negative result of the three experiments established, therefore, a strong probability that the transmutation announced by Prof. Miethe could not be confirmed." (27)

The researchers procured from the manufacturers in Germany an replica of the lamp used by Miethe, and repeated the exact technique described by him. The final run lasted 172 hours, at 165-174 volts/12 amps, depending upon the temperature of the lamp:

- "After the run the most careful analytical tests failed to show any trace whatsoever of the precious metal.

"It is necessary to conclude, therefore, that the experiment described by Prof. Miethe does not always result in the transmutation of mercury atoms into gold atoms. The experiments recorded by Prof. Miethe and our own experiments, conducted as far as humanly possible in exactly the method described by Prof. Miethe, are entirely discordant with each other."

"It would be improper to assert on the basis of these results alone, that Prof. Miethe's experiments have been proved to be definitely wrong. All that is proper to say is that a careful, competent, and long continued effort to confirm the German results has resulted in an entire failure to do so."

The Scientific Americans politely suggested that "one very vital possibility of mistake in experiments of this character lies in the accidental presence of a small impurity of gold in the mercury employed... It is at least possible that such was the case... Perhaps it will be discovered that some minor and unnoticed detail in the arrangements or in the conduct of the experiment was really responsible for a successful transmutation in Prof. Miethe's case... We must confess, however, that we do not believe that this will prove to be the case. On the basis of all the evidence now available, including the experiments of Dr. Sheldon and Mr. Estey... it is our belief that a transmutation of mercury atoms into gold atoms does not occur and will not occur under the conditions which have been described by Prof. Miethe.

"It is to be freely admitted, of course, that a transmutation of mercury atoms into gold atoms is a theoretical possibility. The internal structures of the two atoms are similar. The removal of one unit of positive electric charge from the nucleus of a mercury atom, or the insertion of one additional electron into this atomic nucleus would result, it is believed, in the conversion of the mercury atom into an atom indistinguishable from the ordinary atoms of gold. Quite aside from the failure to confirm the results of Prof. Miethe, it remains entirely possible that one of these changes of atomic structure can be accomplished by some physical or chemical method yet to be discovered." They concluded with sardonic solemnity that "Gold can be extracted from mercury, but mercury cannot be transmuted into gold."

Sheldon and Estey reported elsewhere that "The suggested explanation of a change of the number of electrons in the nucleus changing mercury to gold seems good in theory, but incredible in fact, for the potential drop per mean free path of a Hg molecule is only about 0.1 volt in these arcs." (28)

Scientific American published another report of "More Mercuric Gold from Germany" in April 1926, announcing that a 10,000-fold increase in yield had been obtained in the production of mercuric-gold process. In his first experiments, Miethe found 1 part Au per 100 million parts Hg. The Siemens Works in Berlin bombarded Hg with electrons in extremely high vacuum, and obtained 100 mg Au from 1 kg of Hg. (27)

Siemens & Halske Akt.-Ges. registered their German Patent Specification (#243,670) in June 1925 for "Treating Mercury" with spark discharges, cathode rays, and canal rays. The difference of potential could be between 100-150,000 volts; capacitance was adjustable. Paraffin, ether, or carbon tetrachloride were used as dielectrics (see Fig. 1). (29)

Other researchers were not so optimistic. Erich Tiede, *et al.*, reported "The transmutation of Hg into Au is considered theoretically possible but all experiments carried out under strict control of the original Hg proved to be failures. When the Hg, which was purified according to Miethe and Stammreich, was distilled in an all-glass apparatus similar to the one used by Bronsted and von Hevesey to separate the isotopes of Hg, it showed still up to 10-9% Au. Optical detection is not sufficiently accurate, so they considered it necessary to melt the Au granule, which still held Hg, and weigh it on a microbalance. (32)

Milan Garrett (Clarendon Lab, Oxford) published completely

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negative results of his repeated attempts to reproduce the Hg-Au transmutation experiment by several methods. Garrett also attempted to prepare indium from tin, and scandium from titanium by X-ray bombardment, also without success. (5)

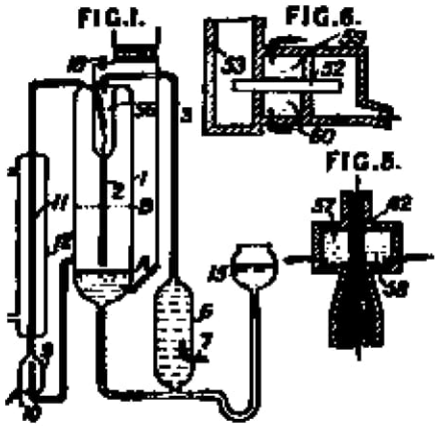

Fig. 1: Siemens & Halske Akt.-Ges., German Patent Specification #243,670, June 12, 1925 for "Treating Mercury"

Erich Tiede, *et al.*, reported that "Hg distilled according to Miethe still had 0.3 mg Au per kg Hg. After two high-vacuum distillations, no more Au could be detected. With this preparation the experiments of Miethe were repeated in several forms; no resultant Au formation was observed in any case." E. Duhme and A. Lotz confirmed this finding. (3, 31)

Duhme and Lotz also conducted numerous experiments with the initial cooperation of Miethe and Stammreich. They used very large arcs: 1.6 m. long carrying 10 kw at 40 kv/800 amps per sq. cm. through Hg vapor. Gold was found in some instances, such as when a sufficiently powerful current was passed between electrodes dipped in mercury, but those experiments were rejected because there had been too much contact with foreign metals. They found that Au will escape detection if certain impurities are present, producing an inhomogenous distribution of Au which becomes detectable only after the arc treatment has coagulated it. (4)

Prof. Fritz Haber, et al., made careful attempts to repeat the work of Nagaoka and Miethe. Mercury in which no Au could be detected was subjected to six different treatments, but no Au was formed. In some cases, Au was found, but only in amounts smaller than what could have come from the materials, or from contamination. Nor could the yield be increased at will. The applied treatments were made with liquid and solid dielectrics with high-tension discharges, arcs in low, normal and high pressures, and high-vacuum electron bombardments.

The extraordinary sensitivity of their detection methods was exemplified by the instance of a co-worker who suddenly found traces of gold in some material he was analyzing. No one else could detect Au in the other samples. It was found that the chemist habitually removed his gold frame eyeglasses before making an observation; on this occasion, he had removed the glasses and then picked up a strip of ultra-pure lead to perform an analysis. Another incident occurred when a lab worker was melting some Au; soon afterwards, another worker in the next room found Au in material which previously had none in it.

The authors described their results as "proving merely that no method has yet been published whereby analytically detectable amounts of Au can be formed in Hg." (8)

Scientific American (April 1926) otherwise reported that at a recent meeting of the German Chemical Society, "Prof. Haber, who previously cherished the greatest doubt as to the accuracy of the experiments, congratulated Prof. Miethe and related... that he himself could confirm the results by repetition of the experiment." Haber made the comment apparently before he had completed his analyses of the electrodes, etc., and determined them to be the source of the Au.

Most of the criticism of Miethe, Stammreich, and Nagaoka's experimental work focused on the questionable purity of the mercury they used. Their Hg had been purified by distillation and by dissolving it in nitric acid (1:4) and fusing the residue with borax (0.1 gr). The resulting bead of Au, if any, was examined under the microscope. Usually they distilled the Hg twice, but in some cases as many as 15 times. Other researchers showed that no matter how carefully or often Hg was distilled, Au could be detected.

Miethe and Stammreich showed that the formation of Au from Hg depends on the application of intermittent electrical discharges. No gold forms when Hg is exposed to direct current. They also described a Hg-turbine which allowed 2,000 breaks/minute with a potential of 110 volts; the current varied from 1-12 amps. The experiments showed a linear proportionality between the yield of Au and the product of wattage and time. The average yield of gold was 0.0004 mg /amp hour. The production of Au was facilitated by high-pressure. When the discharge was passed between Hg poles in a paraffin dielectric, the gold was found dispersed along the line of discharge, but not in the Hg poles. (15)

A. Gaschler attempted to reverse the Miethe-Nagaoka experiment by treating gold with high-speed hydrogen nuclei. He assumed that one of them might penetrate deeply into the electron shells of Au, be held by the innermost shells as a "paranucleus", and form a "Tiefenverbindung". After 30 hours bombardment, the spectrum of the tube began to show Hg lines which steadily in-creased in intensity. Gaschler postulated that Hg is a gold hydrogen compound, similar to Manley's "Hg-Helide". (6, 7, 13)

Miethe and Stammreich showed that the formation of Au from Hg depends on the application of intermittent electrical discharges. No gold forms when Hg is exposed to direct current.

The scientific community gave a fair and thorough review of the claims of Miethe, Stammreich and Nagaoka, who also skillfully managed the criticism. However, the entire issue was never definitively resolved. Therefore, these experiments ought to be repeated with modern equipment and analytical techniques.

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The Transformation of Hydrogen to Helium and Neon

by Robert Nelson

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Dozens of scientific papers were published between 1905 and 1927 concerning the mysterious appearance of hydrogen, helium and neon in vacuum tubes. The matter never has been resolved.

The first such report, written by Clarence Skinner, was published in *The Physical Review* in July 1905: "While making an experimental study of the cathode fall of various metals in helium it was observed that no matter how carefully the gas was purified the hydrogen radiation, tested spectroscopically, persistently appeared in the cathode glow..." Skinner eventually located its source in the cathode.

In 1912, Sir William Ramsay reported "The Presence of Helium in the Gas from the Interior of an X-Ray Tube", and J.J. Thomson published an article "On the Appearance of Helium and Neon in Vacuum Tubes" in 1913. Thomson was investigating a new gas called X_3 (atomic weight 3: tritium), a polymerized form of hydrogen. He used the positive ray method to detect the helium and neon because it is more sensitive than spectral analysis and provides much more definite data. There was no apparent connection between the type of gas used to fill the tubes and the appearance of the new gases (X_3 line 3 in H, N, He, O, and air; Ne line 20 in H, N, O, HCl, and air). Another line often appeared corresponding to atomic weight 10; it is probably due to neon with two charges of electricity, but brighter than expected.

The experimental apparatus was a large glass bulb fitted with aluminum electrodes; the discharge was produced by an induction coil. As Thomson described it, "The positive rays for the analysis of the gases were produced in a vessel containing gases at a low pressure. I shall call this the testing vessel; the vessel in which the various processes for generating X_3, were tried (the experimenting chamber) was sealed on to the testing vessel, but separated from it by a tap. Thus the pressure in the experimenting chamber was not restricted to being the same as that in the testing vessel, but might have the value which seemed most appropriate for any particular type of experiment. After these experiments were over, the tap was turned and some of the gas from the experimenting chamber let into the testing vessel; a photograph was then taken, and by comparing it with one taken before turning on the tap the new gases present in the experiment chamber could be detected."

Thomson eventually determined that the gases were being occluded by the electrodes. He also concluded that "these gases are present in the metal independently of the bombardment, and are liberated by the action of the kathode rays."...

"I would also like to direct attention to the analogy between the effects just described and an everyday experience with discharge tubes --- I mean the difficulty of getting these tubes free from hydrogen when the test is made by a sensitive method like that of the positive rays. Though you may heat the glass of the tube to melting point, may dry the gases by liquid air or cooled charcoal, and free the gases you let into the tube as carefully as you will from hydrogen, you will still get the hydrogen lines by the positive ray method, even when the bulb has been running several hours a day for nearly a year. The only exception is when oxygen is kept continuously running through the tube, and this, I think, is due, not to lack of liberation of hydrogen, but to the oxygen combining with the small quantity of hydrogen liberated, just as it combines with the mercury vapor and causes the disappearance of the mercury lines. I think this production of hydrogen in the tube is quite analogous to the production of X_3, of helium, and of neon..."

Prof. N.J. Collie and H. Patterson conducted the early stages of their work independently and from different points of view. They began collaborating when they learned they were getting the same results. Patterson was interested in the pure physics of the electron, and had developed a hypothesis that "by doubling the electrical charge on hydrogen atoms, it might be possible to convert this into an α particle, and so into helium." Instead, he got neon. The experimenters took all due precautions against error, yet they repeatedly obtained traces of helium and neon. The tubes were surrounded by an exterior vessel which was evacuated, or contained neon or helium; the same results were obtained. In one such experiment, Prof. Collie tested the vacuum-evacuated exterior vessel and found helium with neon. Patterson replicated the experiment, and then repeated it with an oxygen atmosphere in the exterior tube. Neon was found therein. It appeared that neon was formed by a union of helium and oxygen. They also performed numerous blank experiments to exclude the possibility of contamination from various sources.

Other workers, such as R.J. Strutt, found no helium in similar experiments.

In 1914, J. Norman Collie reported his "Attempts to Produce the Rare Gases by Electric Discharge." Finely powdered, heated uranium was placed in a cathode discharge bombardment tube; the equipment was carefully purged in several ways. 1-2 hours of electrical treatment yielded traces of helium and neon in 11 experiments. Collie concluded:

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"If the neon and helium found were due to an air leak, it is difficult to account for the disappearance of the argon, which should have been present to the extent of one thousand times as much as the neon and helium found. The amount of argon present, however, was too little to be measured, as it made no difference in the volume of neon and helium... The presence of the nitrogen is probably due to a nitride of uranium... That comparatively large amounts of neon and helium should come off from uranium by bombardment with the cathode rays, and not by heating, is a matter of interest; also that in one experiment a change of coil should affect the result is an observation that must if possible be repeated... "

"That the presence of neon and helium in vacuum tubes, after the electric discharge has been passed, is due to an air leak seems most improbable. Where the gases come from has yet to be proved. They have been found by Sir J.J. Thomson, by Sir William Ramsay, by Mr. G. Winchester, and by the author [J. N. Collie], Mr. Hubert S. Patterson, and Mr. Irvine Masson... Whatever the source may be, it is only by further experiments that the question will be resolved..."

"by doubling the electrical charge on hydrogen atoms, it might be possible to convert this into an α particle, and so into helium." Instead, he got neon. The experimenters took all due precautions against error, yet they repeatedly obtained traces of helium and neon.

Collie, Patterson, and Masson described the electrical circuit, discharge tubes and testing apparatus, precautions and controls, bombardment experiments, results, and possible sources of the gases in the *Proceedings of the Royal Society of London* (1914):

The coils gave 12-inch sparks with either a mercury or a hammer interrupter. The nature of the break has some influence on the result of the experiment; in the case of a mercury break, better results were obtained with a rectifier. The current in the secondary circuit averaged a few millamperes. The form of the discharge tubes varied from simple spectrum bulbs with disc electrodes to elaborate jacketed designs. The gases employed were generated by chemical and electrical methods and were tested for purity.

The testing apparatus was either directly connected to the discharge tube, or the gases were transferred by means of an inverted siphon over mercury after being pumped from the reaction vessel. Hydrogen was removed by exploding it with oxygen in a burette or in the collection tube, which had platinum wires sealed in it. In some designs, the hydrogen was removed by copper oxide and phosphorus pentoxide. Oxygen and moisture were removed by cooled charcoal, liquid air, and Na-K alloy. The He and Ne were collected in a fine capillary tube with a fine platinum wire sealed through the top.

According to the authors, "It is found that the minimum quantity of neon detectable probably equals that contained in a few cubic millimeters of atmospheric air. If, owing to defective working, the neon actually was atmospheric, the accompanying argon would be very easily seen (as the ratio Ar:Ne in air is about 700:1) when the particular method used was such as might have eliminated nitrogen beforehand; in the apparatus depicted, nitrogen naturally made its presence at once evident if a very small part of a cubic millimeter of air was present... In many of the experiments, the total volume of gas used was so small that even if it had been all atmospheric air, it could not have accounted for the quantities of the neon, and still less for those of the helium, which were obtained... We wish to point out that a great many of our experiments have yielded negative results, for as yet unexplained reasons."

The electrodes were made of Pd, Cu, Pb, Tl, Li, Na, K, Al, and Mg. Some bombardment experiments were conducted with anti-cathodes of Pt, Tl, U, KF, KCl, KI, RbCl, Cs_2CO_3, CaO, and BeO.

Besides the several precautions against air-leaks, Collie, *et al.*, tested for nitrogen; the ratio of N_2:Ne in air is about 80,000:1; "If the Ne detected in an experiment came from air, the nitrogen accompanying it would be found in relatively overwhelming quantity...

"If atmospheric contamination occurs at any point after the run, nitrogen must infallibly be detected during the examination. If any contamination occur before the run, it would likewise instantly be made manifest on the first passage of the discharge through the experimental tube. It is only when an infinitesimally slow leak goes on during the run that it is possible that no nitrogen could be seen at any time; and to provide against this contingency an additional control is necessary, namely the absence of argon from the gas... The argon test is in reality superfluously delicate as a control; nevertheless it was used.

"In all experiments where helium was the chief product, atmospheric contamination is *ipso facto* excluded... contamination seems to be thoroughly excluded in all the experiments."

Two hypotheses remained to explain the origin of the He and Ne: permeation through the walls of the tubes, and previous occlusion from them. Since positive results were obtained with electrodeless tubes, the electrodes can be eliminated as a source. In addition, when Al and other metals were melted *in vacuo*, no gases were occluded, but did so when the metals were bombarded; no He pre-existed in the metals. When Al was dissolved in KOH solution, no He or Ne was liberated. Melting the glass tubes in vacuo yielded no He or Ne. Two specimens of old glass (one Egyptian, approximately 1500 years old; another, Kienlung Chinese) were examined; neither yielded He or Ne.

The authors closed their report by noting that "We have endeavored to put the facts of the case as fully as possible, without reference to any preconceived theory. It is not our view that our experiments rigidly exclude all the possibilities which have been mentioned; but it is evident that the trend of the results is toward conclusions which, if they turn out to be true, would be of very obvious importance."

The issue then lay dormant for several years, but research was resumed after World War One. In 1926, Prof. Fritz Paneth and Dr. K. Peters determined that palladium had effected the transmutation of hydrogen to helium in their experiments. Paneth and Peters absorbed H in colloidal Pd (sponge, black, or palladinised charcoal) for 12 hours, after which time they detected the main spectral lines of He. No He production was observed with Pd preparations that had not absorbed hydrogen. Preparations of Pd stored at room temperature should therefore produce He; this was found to be the case. After the He had been removed, the sample was stored again, then examined; more helium was obtained. The experiment was repeated three

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times with the same results.

The authors excluded all the possible sources of error in their experiments, such as the ingress of atmospheric He, absorption in glass or electrodes, preferential absorption of He by Pd, and the possibility of He being formed as a product of radio-active disintegration of Pd. No trace was detected of any energy liberated during the transformation, either as heat or radiation.

It would seem worthwhile and desirable to replicate these experiments with modern equipment and techniques.

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1989. This, he says is "the work for which they are known" which makes it "the basis of all discussion." He wants to compartmentalize the discussion. He wants to consider experiments in isolation, out of context. Recent work can never put to rest issues raised in earlier papers. The debate never gets past square one. He segments information. When the topic is tritium, he will look at the experiments of Fritz Will or Bockris, but not both. He does not see that one result bolsters another.

Britz seems to be looking for a single, isolated, perfect experiment that leaves no grounds for doubt. I do not think a researcher can do a perfect experiment, although McKubre and Pons and Fleischmann have come as close as humanly possible. No paper is perfect. You can always find a weakness, or an unanswered question. A researcher cannot accomplish every goal in one experiment. Equipment designed to detect neutrons or x-rays will be poorly insulated, which reduces calorimetric precision. You snip away at the good calorimetry papers because the authors do not look for x-rays or neutrons, and you sneer at the x-ray papers because the calorimetry could be improved.

Britz and I agree that independent replication and quality research are crucial. He sometimes agrees in private that there have been several quality papers, but he never discusses them in public. When people ask him for examples he pretends they do not exist. Months ago someone new to the field asked Britz for an example of a compelling excess heat paper. Out of the blue he began talking about the work of Robert Huggins. Huggins is a superb scientist and his papers are important, but his research was never funded properly, and it was soon terminated. He was not able to follow up with the kind of conclusive studies other researchers later performed. When Britz was asked for a convincing example, why did he turn to this minor and obscure experiment? Why didn't he list Pons and Fleischmann, or McKubre, Bockris or Storms? I think he wanted to give the impression that the only significant cold fusion replications are found in obscure papers written by people who stopped working in the field years ago.

Britz takes compartmentalization – the refusal to look at the totality of results – to such extremes that he cannot bring himself to compare the beginning of an experiment with the end, or the first half of a paper with the second half. He does not see that the boil-off phase of the Pons-Fleischmann experiments confirms the low level heat; and when Bockris detected tritium that made it more likely his excess heat calorimetry was correct, since one nuclear effect is likely to accompany another.

Compelling Evidence and Single Thermocouple Obsession

Why did Britz argue back and forth with me for a week about the number of thermocouples in the IMRA cells? Why does he refuse to contact Miles, or IMRA for that matter? Why does he go through these mental gyrations to deny a simple matter of fact? Why does he cling to this tiny margin of doubt, and try to convince other people that Pons and Fleischmann tested gradients only once? I believe he faces a dilemma. He realizes that the evidence for cold fusion is compelling. It is overwhelming, there is no room for rational doubt. But he does not want to believe it. He is a conformist. He loves to be on the side of the authorities, to follow the right forms, and stick close the peer-reviewed truth. He has invested hundreds of hours in his data base and built a reputation with the other conformists. For years he has attacked distinguished electrochemists for believing in "bullshit." How can he admit to himself they have been right all along, and he was a fool for refusing to look at their work?

Skeptics have a large emotional investment in their beliefs. So do we, but we also have rational, carefully thought through reasons to justify our beliefs, whereas Britz cheerfully admits that he cannot think of a single reason to bolster his doubts. In public he sometimes says: "I believe there are in fact points of attack in their work." Other days he cheerfully admits he does not know any points after all. I wrote to him: "you cannot give me a technical reason to doubt the calorimetry of Miles, Pons and Fleischmann, McKubre, Oriani or any other quality worker." He nonchalantly agreed: "I don't, and you might notice I usually don't even try. . . . I also regard [these people] as quality workers and they are the ones who force me to give that kind of cold fusion a small chance. I am waiting for the big revelation, the hot news that here we have large-sigma, compelling etc. evidence."

This revelation arrived years ago. The best cold fusion data is more compelling than the proof of other recent extraordinary claims in physics. The signal to noise ratio is higher, the tests have been repeated more often. By objective, quantitative standards we should have convinced most scientists already. Cold fusion is easier to replicate than a hot fusion tokamak or the Fermilab quark experiment. To judge these big physics projects in detail you must evaluate of hundreds of different instruments and thousands of parameters, whereas cold fusion calorimetry has only a few basic parameters. Controversial, difficult and extraordinary claims like the existence of the top quark and the hypothesis that an asteroid strike wiped out the dinosaurs have been largely

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How Cold Fission Has Extended My Belief in the Existence of a Catalytic Particle

by Joseph L. McKibben, Ph.D.

The release of information in IE in the combined issues #13/14 upon the development of the Cincinnati Group supports my case for the existence of catalytic compound particles at low abundance in water. The fact that all of the thorium appeared as copper or titanium within experimental accuracy is quite interesting. The fact that the container and its internal electrode needs to be, or works best, if made of zirconium is indeed interesting.

There were no neutrons observed in this decay. There were no gamma rays above that emitted in the natural decay of thorium—if they were involved in a significant way in the "fission" of thorium, their intensity would be very much larger. That also means there were no neutrinos releasing unobservable energy.

The most surprising thing to me was that no significant heat energy was observed. I now speculate that the fission energy loss is due to color-charge radiation due to the back and forth oscillation of the subquark without its normally-attached alpha particle while inside the thorium nucleus.

Formation of Copper and Titanium

On pages 18 and 20 of *IE* issue #13/14 it was emphasized that the amount of thorium that had undergone transmutation was equivalent to the amount of titanium and copper that had been formed was within experimental error. My view of what happens is that a Sq-^{4}He catalytic ion enters a thorium nucleus and starts to oscillate along a diametrical axis. The material surrounding the oscillating core forms lumps the size of nuclei. There can be only three copper nuclei since Z is 29, 87 of the 90 protons of thorium are used up. In addition to the three protons 34 neutrons are left over. While mass 63 is most abundant in nature, mass 65 is far more abundant here. Four titanium nuclei where Z=22 use up 88 of the available protons. Besides the two protons 38 neutrons are left over. Since in cold fusion the subquark appears to be capable of converting pairs of protons into deuterons and joining pairs of deuterons into helium, it seems logical to assume it can join pairs of neutrons into deuterons in this case too.

Absence of the "Fission" Energy

The cold "fission" process appears to not have delivered any energy to the zirconium container although its complete absence has not yet been demonstrated. This to me was a big surprise. Then I realized that the "fission" energy, which is ≈210 MeV, was quite capable of releasing the alpha particle from the subquark since its binding energy is only ≈60 MeV. Since the subquark alone is 11.4 times less massive than the catalytic pair and is in a high temperature environment, radiation from its back and forth oscillation may take place. Since this is color-charge radiation, it could be present but not detected by the Cincinnati Group. Can this radiation be the scalar waves that I have heard discussed but I have not yet comprehended?

Keeping the Subquark from Attaching to the Walls

As just noted, a subquark likely loses its alpha particle upon its first encounter with a thorium nucleus. The AC electric field applied to the water keeps it traveling in the solution; however, it still is apt to get to the wall and stick. How firmly the attachment would be depends upon the metal. The Cincinnati GroupP found that it was important to make the container out of zirconium. My chemistry handbook suggests to me that zirconium has the most tightly bound oxide layer of any of the elements. This in turn suggests that it repels the subquark with a charge of only +e/6 better than any other metal could. The subquarks color charge is causing it to be attracted to the wall but it fortunately appears to be a short range force. Zirconium's strong attractive force for negatively-charged elements is able keep it from becoming bound to the wall.

Rocket Propulsion by Thorium

If the catalytic particle used is ^{16}O with two subquarks, it seems likely the "fission" of thorium will take place without the energy being radiated away. This is because the binding energy between the subquarks and the oxygen nucleus is hopefully too great for even one subquark to get free it will take an experiment to find out. Calcium would be a good place to find ^{12}C nuclei with one subquark and it would be bound by ≈180 MeV so maybe they stay attached and do not radiate. Experiments along this line are badly needed. If radiation does not take place, the atoms will either have a high temperature or high kinetic energy depending upon the method of confinement used. If so, it is plausible that NASA could develop a super rocket engine. There would be a lot of engineering problems to solve but before trying to discuss them, the best mass to attach to a subquark needs to be experimentally determined. That would be a superb way to use our radioactive waste.

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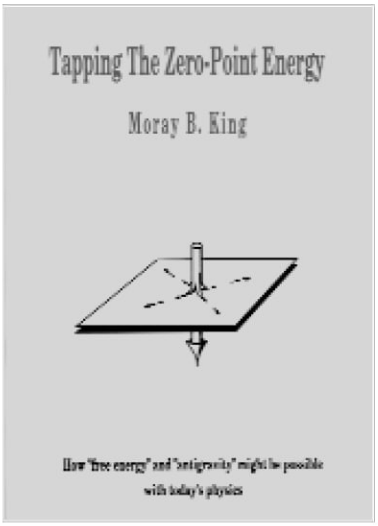

Archive

CONVENTIONAL ELECTRIC MOTORS

by Dr. Robert Adams

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As all electric motors are rotary devices with inductive componentry in their make-up, they are subject to the forces of nature, particularly electromagnetic and etheric forces. Conventional motors all have a very low efficiency factor. They are lethargically taken for granted and have not improved in the 100+ years since their inception.

The problem obviously stems from the lack of knowledge of magnetism and etheric forces, the latter in particular because it was discarded long ago by the establishment of the day. In these enlightened times however, through people like Reich, Drown, Stiener, Tesla, Sweet and others, the ether presence has been re-established and proven once and for all time by the true scientists, that it's existence is ever present in an awesome and infinite measure.

Conventional electric motors, like combustion engines, work against the forces of nature and instead of being in tune with these natural forces, work in opposition to them. The result of which both such devices are intrinsically and grossly inefficient, *i.e.* the bulk of energy involved in their operational process is wasted in heat.

The vital point of action in an electric motor takes place in the air gap between the motor stator and the rotor magnet/electromagnet as it comes into register. The method devised to harness the energy within this vital area is of paramount importance. If it is deficient and out of tune with the forces of nature, it precludes taking full advantage of the potential power the etheric energy within that gap can provide. So we have here conventional motors using a brute force method of extracting potential energy at a prohibitive cost of energy loss in the form of heat. It is the author's belief that this is the cause of the excessive heat displayed and consequent abysmal efficiency of conventional electric motors.

The truth of the matter is that conventional electric motors, because of their faulty design, lack the gating mechanism necessary to take full advantage of the potential *etheric energy* in that air gap.

As I have pointed out many years ago, no amount of sophisticated computerized or otherwise electrical/electronic measuring equipment will ever indicate true input power to these machines. Why? Because the people are reading all the wrong parameters; there is only one parameter that reads true input power - that of temperature.

What the author now wishes to point out is that all electric motor manufacturers strive with an ill conceived notion to design and construct motors with the lowest possible 1^2 R loss. To apply this technique, if indeed it should be called a technique, simply compounds the problems of an already glaringly inefficient machine. The solution to the dilemma is right before their eyes in that very area, but without the necessary cognition, it remains elusive to these people. The solution, if ever discovered by these people, and applied, will affect at least three important parameters of the machine's operation which will, in turn, result in increased efficiency.

The Secrets of the Adams Open Magnetic Circuit Switched Reluctance Motor Generator - More News for the Establishment Teaching Fraternity and Others

Conventional electric motor designs are grossly inefficient for three reasons, one being that stator resistances are low, two that they involve a closed magnetic system and three that they are fed energy in a brute force manner to overcome reverse torque, which in all, results in excessively high current dissipation and resultant high energy heat loss.

Where the drag back effect between a permanent magnet and a rotor, passing through register with a stator, equals the force of attraction and repulsion of the magnet, then no electric motor can rotate, let alone deliver torque!

Firstly, with the "Adams Open Magnetic Circuit System", I refer the reader here to the paper headed, "The Secret of the Adams Motor". Now, in the method of conserving energy and overcoming the reverse torque of electric motors, I engage the impulsed *switching* circuit, and high resistance stator windings simultaneously with the open magnetic circuit system and known as the "Adam Switched Reluctance Electric motor generator..

All iron is endowed with an inherent magnet* unified charge, so we have in permanent magnet motor stators consisting of iron and copper, this latent energy. Now when the rotor with it's permanent magnet poles reach the stator and come into register with it, the stator at this moment is applied a small current to produce a repulsion charge field acting against the similar pole polarity of the rotor magnet, thus applying torque in the rotor. It is to be noted however, that when a pulse is injected into the stator, it ads on the inherent unified charge field of the stator winding and the unified charge of the stator iron core, thus amplifying the resultant unified charge, repulsing the rotor magnets and thus sustaining motion.

In essence, the unified charge is acted on in such a way that the stator crystals are temporarily aligned and it becomes magnetized. Hence, as explained above, the magnetic circuit of rotor poles and stator poles are endowed with a self-demagnetizing effect, enabling the motor to require only a fractional amount of current to neutralize the magnetism in the rotor poles, and thus producing a magnetic field acing against that of the magnet(s), upon reaching the in-register position, thereby eliminating the reverse electrodynamic torque. The fractional current pulse injections in addition to the magnet(s) and stator(s) combined demagnetizing field, produces a powerful coupling into the unified charge of the Aetheric/Space Energy within the air gap between the rotor and stator and hence, manifesting considerable torque into the rotor for free.

The author points out that the demagnetizing effect in the *Adams* motor described, is *not* a theoretical assumption. It has been proven in a simple unique static assembly in the laboratory many years ago and demonstrated since to a number of my colleagues.

This demagnetizing effect, in an open magnetic circuit described, will not be found in standard establishment texts. Like a number of other discoveries I have uncovered over the years, they don't exist in so called "modern texts". I lay claim therefore, to these many electromagnetic discoveries.

When I discovered in my earlier years, that what I had been taught at school was a deliberately orchestrated diet of what was in fact, merely considered comfortable for me to digest, it led me to pursue further the question of why? The intrigue grew as I discovered that maths, social studies, history, etc. and later on at college, science, physics, engineering (particularly electrical) were all subjects curricularised, *i.e.* prescribed and subject in themselves, to censor from the "appropriate governmental authorities. This was over sixty years ago and it is not one bit different in 1997!

Our children and grandchildren today remain intellectually cloned with governmental and world established paradigms of yesteryear, with no apparent indication of any inclination on the part of the educationalists to break through to new frontiers. General mainstream academia remains so stultified as we head toward the 21st Century that it's embodiment is enshrined like the Rock of Gibraltar. A new teaching mentation must take place. New science is way ahead of present day education and 'awareness' is catching up fast.

If we must have prescribed teaching, then let us update our curriculums, dispense with peer review and the trash of the last century (and I emphasize here in particular physics and electrical engineering) and get on with a new structure of thinking and *not fear doing so*.

I have kept much knowledge of certain discoveries I have made to myself in the past because to have pursued the results of these discoveries at the time they were made (*i.e.* up to as far as twenty-five years ago) would quite simply have put me out of the running. And that I could not have. It would have to wait.

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The test of time may be cruel but it's result is profoundly positive, for over the more recent years, time has been my ally.

I now release this knowledge, or should I say a goad portion of it and in so doing, will expose what I call "false teachings" in the fields of electromagnetics, electrodynamics and the so called LAWS of thermodynamics, all of which, within themselves, in turn affect the correct and valid methods of testing electric motor efficiencies and other important relevant factors pertaining to other clean energy devices.

It is in this time that we find ourselves embarking on yet another new stage of scientific and technological enlightenment. In these modem times of what we consider to be advanced technology, particularly in the sciences of electrical and electronic engineering, we find ourselves still using orthodox methods of testing electrical machines. Here, I refer to the bizarre methods of measuring power.

Why, as we head rapidly towards the 21st Century, do we, in the calculation of input/output power of modem day new energy devices, such as electric motors, find ourselves stubbornly holding fast to the age old parameters, as used in the days of lore for the determination of efficiencies of the James Watt steam engine, horse-drawn carriages and Joule's water paddle experiments? I cannot help but consider the foregoing to be a grotesque travesty of our modern day science, where the majority are still persisting in doing themselves the injustice of hibernating their structure of thinking within the warm protective shell of such obsequious obsolescence. It seems almost obscene, that in this age our bastilles of reaming still contend themselves with such sublime occupence to so ancient a regime.

I would refer the reader at this point to an excellent paper which is included in the book entitled 'Thermodynamics and Free Energy' authored by Peter A. Lindeman of the United States of America. To quote Lindeman - "Once again we have entered a new scientific era where the *exact equivalence* between mechanical work as *foot pounds*, electrical work as *watt hours* and heat as *BTU's* is *NOT KNOWN*." Unquote.

According to our text books and teachings, a neutral vacuum is empty. It has now been proven to be a condition of space, in which electrical manifestations are present in a primordial sea of energy and in an uncondensed state, remaining unrecognizable until it begins to get into a vortex system - a force field of nature.

Permanent Magnets and Work

Permanent magnets do not and can not *DO WORK* as claimed in some certain circles. It is the unified charge field *aetheric* forces that provide the energy in electric motors and generators alike. This unified charge is harnessed at the air gap of the machine. The magnets in this situation, due to their motion, are simply acting as a gating device and harnessing the *aetheric* unified charge force field.

There are many concepts to be considered in relation to conventional electricity. It is a three dimensional rotation and can only manifest through motion.

Reference now to the role played by stators. There are a number of factors to be considered here. Motor stators generally consist of non-retentive soft iron or laminated steel; they are by nature, endowed with a magnetic unified field of their own, - this also applies to the stator copper wire windings. So you have something here that is already in motion, i.e. the unified charge field of the stator and copper mass. Upon an outside source of energy being applied to these stator windings, the ever present unified charge magnetic field within the entire stator system expands and contracts during the 'in' register period of the air gap. The external energy applied to the motor stator windings moves not through the winding wire, but circulates in a spiral motion around the surface of the wire. Increasing the mass by increasing the number of turns of wire, increases the electromagnetic energy developed, and reduces input power and temperature. This resultant energy increase can also be further increased by raising the supply voltage, until maximum magnetic alignment is reached.

Contrary to established teachings, the applied EMF does *not* create the resultant electromagnetic energy. It simply expands and contracts the ever present unified charge of the stator componentry system. Irrespective of any type of electric motor, including permanent magnet types, the energy developed is derived from the *aether* within the air gap of the said motor rotor and stator.

The problem with conventional electric motors is that of having to provide considerable extra energy to overcome the equivalent reverse torque/back EMF effect. The advent of motors of the Adams design overcomes this serious problem and, with careful design features, provides us with motors of a very high order of efficiency and consequent low operating temperature.

There are certain parameters required to be implemented which do not apply to conventional D.C. electric motors - those of operating potential, stator winding resistances, winding wire size and quantity. These particular parameter requirements are different to those pertaining to conventional D.C. electric motors. The established gaseous electrostatic electricity moves over the surface of the winding's wire at a super luminal velocity. This creates an enormous increase in inductance, which in turn retards, or tends to block off the movement of electrons. hence a consequent reduction in current flow is possible, according to machine parameter variables applied.

To understand *Tesla Aetheric* forces technology, one must eliminate the notion that electrons are the working gremlins of electrostatic energies. We are considering here an entirely different kind of electricity, endowed with totally different characteristics, which therefore requires a new and different approach to the method of calculating the performance of such a device, as the disparity between the two is immense, especially power input, and resultant low temperature, indicating high efficiency.

An Adams D.C. Impulse Electric motor can be designed in such a way that the succession of charge and discharge impulses develop energy of such magnitude that it may be possible to have control of the flow of conventional electricity electrons through the complex metallic lattice of the very long length of wire used in the stator system; due to it's super luminal velocity, of which the gaseous pulse flows over the coil surface. This then could provide us with an electric motor that requires very little current at nominal voltage whilst yet delivering considerable power at low temperature and at an efficiency rating never before reached in an electric motor.

It is impossible to comprehend this 'Tesla Technology' without considerable knowledge of the *Aether*. One must seek out and study the proofs, of which there are now many that have been established by experimenters worldwide. It is a technology capable of being explained through gas dynamic analogues. The fact that even partial elimination of electrons from *Aether* currents takes place, indeed spells out that this is a new kind of electricity which could find no resolution in present electrical science. This new energy technology is going to change the world we live in, on an immense scale.

Temperature Measurement of Electric Motors

Temperature and/or calorimetric measurements can be very time consuming and tedious and because of the inherent nature of heat, it is required to be measured on a time basis. However, with the necessary experience and facilities it is possible to calculate results with only five minute runs. Calculations of measurements however, can take a good deal longer. Much depends on experience, the type of motor under test and equipment en gaged in testing.

It is not just a simple matter of measuring temperature - such important factors as Joules Law, mass, temperature, time - then conduction, radiation and ambient temperature must all be considered. As earlier pointed out in my previous papers, this kind of exercise requires considerable experience and skill.

An accurate method of checking temperature must be applied to electric motors. For instance, to ascertain accurate temperature reading of a motor, the core of a drive-winding must be drilled deeply into it's centre to provide for an electronic probe to enter the centre of that core. The greatest degree of heat generated is at this point, and this is termed the hot spot from which the temperature must be measured.

It is to be noted that the temperature difference at this point described is very substantially higher than that measured on the outer perimeter of windings and or frame periphery.

Established Methods of Testing Electric Motor and Transformer Efficiency

In this section I challenge the method(s) used in science and industry alike in relation to the testing of electric motors and power transformer efficiencies. The methods referred to are in

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the form of the well known and outdated establishment teachings. The establishment will not attempt to take up my challenge because they know full well my claims are proven.

These outmoded methods have gone on forever over the ages and been taken as gospel, never to be questioned. The time has come to pass, that these outmoded methods be subject to review. With new energy devices over the horizon, application of establishment testing procedures for these do not, and can not give accurate results any more than they do for present day conventional devices.

It is well past time that the establishment science and industry alike be taken to task on this matter, particularly in relation to electric motors and transformers.

Test results from universities and establishment facilities of new energy devices I have encountered, are not worth the paper they are written on.

Let's start with power transformers. A simple no-moving-parts device.

Claims of upwards of 98% efficiency!

I ask one question. Why, in the case of large power transformers, as used for the national grid systems, claiming ratings of around the order of 98% efficiency, do they have to be immersed in large tanks of special transformer cooling oil to keep the transformer at a safe operating temperature? And, in addition, the transformer tank is fitted with oil circulating fins around it's outer perimeter which, in turn, cool the hot circulating oil and, so too in many cases, these transformers *also* require a circulating pump? 98% efficiency? If the so-claimed transformer *was* indeed around the order of 98% efficiency, it certainly would not not be required to be immersed in an oil tank, with it's ancillary devices, to keep it cool!

Now electric motors.

I ask the same one question. Why do motor manufacturers, claiming upwards of 90% efficiency, provide cooling fans in their machines with their attending losses, in order to keep the machine within a safe operating temperature? Simply because of the heat generated in the machine due to inherent inefficiency losses? What 90% efficiency? If the fan/s were not provided, the machine would surely self destruct due to the excessive heat generated.

So much for establishment teachings of efficiency ratings of electric motors and power transformers. I have acquired and tested scores of A.C. and D.C. electric motors over many years and failed to find a single one which conforms to the manufacturers specification efficiency data claims.

The Testing of the Adams Impulsed Electric Motor

The ADAMS motor is essentially a D.C. unconventional machine which defies the laws of physics, the conventional motor on the other hand, as purported by establishment teachings, does of course not defy the laws of physics. This is pure assumption; refer to my paper: Applied 20th, Century Aether Science", and thus it is accepted practice to engage conventional physics calculation methods to determine their efficiency. So from the foregoing does it not make common sense to realize that the conventional testing of a motor that defies physics as we have been taught, can not possibly apply to a machine that defies conventional physics?

I have been trying for years to de-programme people (who should know better) from applying conventional methods to over unity devices, in particular, impulsed electric motors. It is now well known that impulsed electric power applied to these motors is extremely difficult to measure accurately no matter how sophisticated the instrumentation used. And I have been saying this too for years.

With beyond 25 years of experience in the design, construction and efficiency calculation of these motors, I claim to be the first person in the world to have discovered the correct and accurate method/s of calculating input power of impulsed D.C. electric motors. The secrets of which I deliberately kept to myself for so long. These I now reveal. The methods I am disclosing are so simple, obvious and accurate, that they can not help but even enlighten a great many people involved in mainstream academia and also those in the field of free energy worldwide.

In brief, the secrets are that the conventional and unconventional motor must be tested on a comparison basis, i.e.

WATTS to WATTS, TEMPERATURE to TEMPERATURE.

To quote the editor of Extraordinary Science Magazine U.S.A. (Steven R. Elswick) Volume V, June, 1993 Issue.

"*Comparison tests* must be developed where new technology can be compared against current technology. We need to be *comparing* WATTS to WATTS, JOULES to JOULES."

To quote what Adams discovered in 1973:

WATTS to WATTS, TEMPERATURE to TEMPERATURE..

This is, in our present day climate of orthodoxy and dogma, the only true method of assessing efficiency where unconventional new technology is involved. It is abundantly clear from the foregoing, that what I said over 25 years ago still applies - *i.e.* that conventional testing of conventional electric motors belongs *only* with *conventional machines*, and simply does not apply to unconventional motors, *i.e.* typically those of the *Adams* D.C. impulse type motor. As pointed out in my previous papers, temperature measurements are verifiable and therefore irrefutable. Temperature read outs of electric motors at work are of paramount importance, and electrical parameters don't even need to be considered.

These outmoded methods have gone on forever over the ages and been taken as gospel, never to be questioned. The time has come to paass, that these outmoded methods be subject to review.

The accessing of *Aetheric* energy en masse at high efficiency can only be achieved with the application of *sudden uni-directional direct current impulses of high potential*, activating windings of very high inductance, for which the *advanced Adams* impulsed motor was designed. The application of impulsed reversal A.C. current will not access/gate *Aetheric* energy on the scale that D.C. displays

The afore going figures indicate the significance of parameters generally ignored by the mainstream of academia, and others who are unable to shed the notion that the application of E x I and electron flow theory tells all for calculating the efficiency of over unity electric motors, this is not so!

It is clear from the foregoing, that what I said over 25 years ago must apply - *i.e.* that conventional testing of conventional electric motors *belongs* only with *conventional machines* and simply does not apply to unconventional motors, *i.e.* typically those of the *Adams* D.C. impulse type. As pointed out in my previous papers, temperature measurements are verifiable and therefore irrefutable. Temperature read outs are far more important than electrical parameters and are far more accurate in calculating efficiency.

The accessing of *Aetheric* energy en masse at extremely high efficiency can only be achieved with the application of *sudden uni-directional direct current impulses of high potential*, activating windings of very high inductance, for which the *advanced* Adams impulsed motor was designed. The application of reversal A.C. current will not access/gate *Aetheric* energy on a large scale at high efficiency.

WATTS TO WATTS TEMPERATURE TO TEMPERATURE

In the final analysis we have:

The Adams discovery in 1973 for temperature comparison of electric motors for efficiency calculation does not require electrical parameters to be considered. This then in turn, is a far more accurate method of ascertaining true input power in addition to avoiding instrumentation error, confusion, and subsequent controversy. As pointed out in my previous papers, temperature readings are irrefutable, leaving no room for doubt.

SOLUTION

CONVENTIONAL MACHINE	257° RISE
ADAMS MACHINE	60° RISE
	= 257/60
	= 4.28333
	= 428.3%

Appendix

Efficiency indicated on the typical "ADAMS" comparison

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Typical Adams and Conventional Motor Test
Conventional Calculations 1 HR Run, Electrical Load

½ H.P. CONVENTIONAL MOTOR		½ H.P. ADAMS MOTOR	
INPUT POWER	[illegible] WATTS	INPUT POWER	150 WATTS
VOLTAGE A.C.	240	VOLTAGE D.C.	140
STARTING CURRENT	12.95 AMPS	STARTING CURRENT	2.4 AMPS
RUNNING CURRENT	1.79 AMPS	RUNNING CURRENT	0.71 AMPS
MASS	1.5 Kg	MASS	0.85 Kg
OUTPUT POWER	100 WATTS	OUTPUT POWER	105.6 WATTS
STATOR OPERATING TEMP.	277°C	STATOR OPERATING TEMP.	60°C
AMBIENT 20°	257° Rise 1 Hr	AMBIENT 20°	60° Rise 1 Hr
EFFICIENCY	23.2%	EFFICIENCY	100.6%

Note: Conventional 1/7 H.P. motor input powers range from 400-500 Watts

CONVENTIONAL MOTOR SHAFT CONNECTED TO G.E.C. D.C. GENERATOR	ADAMS MOTOR GENERATOR OUTPUT CONNECTED TO RESISTIVE ELEMENT IN CALORIMETER

COMPARISON RESULT

EFFICIENCY 23%	ADAMS MACHINE TRUE EFFICIENCY BECOMES 429.6%

motor test sheet can vary according to variations in applied electrical parameters, it is as stated a *typical* comparison test. Any number of variations are possible by design, experiment, or for convenience, by adjustment of duty cycle. For instance in the initial trial runs of this test procedure, the machine upon adjustments being made displayed output powers of from 114 watts, 111 w and 107 w, before duty cycle was finally set to equalize with the projected 100 w output approximating a 1/7 H.P. situation.

Conventional motors must be provided with an efficient cooling system in addition to the aid of a cooling fan, a system which is capable of dissipating the largest possible quantity of heat from the smallest dissipation area. The fall of the central internal temperature must be as small as possible, whilst external temperature fall must be as high as possible, ensuring a good heat transfer. The important factor here is to limit as far as possible, the temperature rise in the windings beyond ambient.

It is a habit still in vogue, of measuring temperature by touch, this unbelievable primitive procedure serves only a completely erroneous and imaginative indication. The matter of accurate temperature readings are of vital importance and should be

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

ascertained by following the procedure as outlined in the author's paper titled "Temperature Measurement of Electric Motors" which is included in this treatise.

The temperature of the motor frame surface does not provide evidence of any substantial value without knowing the internal motor windings temperature, there could well be a variation of upwards and beyond 100°C. It is to be noted also that such factors as power rating, mass, construction accuracy and material types all have their collective effects in the efficiency of ensuring a desirable heat transfer from the windings. Finally, the advantage of temperature based measurements is that they are based only on purely measuring two simple physical quantities, *i.e. time and temperature*, and so dispensing with the controversial difficulties encountered with measuring electrical parameters of motors that involve input power switching circuitry.

Britz continued from page 69

resolved with *far less reliable data* than we have to offer. Britz disagrees:

> I can't find any errors [in Miles, McKubre, Oriani etc.], you are right. That is not the same as saying that I believe their results, the signals are not large enough. I know you say they are high S/N, I say these are too sporadic for me. McKubre seems to agree and he has done some of the best work.

Cold fusion results are sporadic because they are difficult to reproduce. This has never been held as a reason to disbelieve results in other fields of science. Indeed, scientists often brag they can perform difficult experiments that other people cannot. They boast about the arcane complexity of their research. They do not add, "this means my results are probably wrong." Only one group of scientists at Fermilab managed to do the top quark experiment. Only one group has explored Mars. People do not doubt these results despite the fact that the experiments are difficult, expensive, and take decades to complete. The official EPRI publications leave no doubt that McKubre and his sponsors are sure the results are real. They know why the experiments are difficult to reproduce, and which factors are not under control. "From the conditions of loading, initiation time, and current density on the successful observations of excess heat, it is understood why the phenomena are so difficult to attain."[7] McKubre says he understands why other people do not believe his results: because they have not seen it happen in their own labs. But 'other people' have not done the experiments, and they could not do them even if they wanted to, any more than I could send a robot to Mars. These other people are not expert electrochemists, and they do not have millions of dollars.

Ultimately our dispute comes down to a difference in philosophies. I believe the scientific method dictates that when you run out of arguments, and you no longer have a reason to doubt compelling evidence, you must believe it. Doubt without foundation is irrational; it is no better than belief without foundation. Britz thinks that a scientist must have a good reason to believe in A or B, but he can disbelieve X or Y for no reason. He can ignore X or Y, or attack them without reading the papers. Arguments about objective quantitative standards of evidence in comparison to other fields make no impression on him.

What Constitutes "Compelling" Evidence?

Britz says that evidence which appears compelling may not be after all because of an undiscovered artifact. That is true, but the example he gave to illustrate the point shows that he fails to fully understand the concept of "compelling" evidence. He based this hypothetical example on an early cold fusion experiment. In 1926 Paneth and Peters tried to produce nuclear fusion by loading palladium with hydrogen. They detected helium. They thought this was a fusion product until they checked more carefully and realized it was contamination. Helium was leaking in through the glass walls of the cell faster than they predicted it would; the hydrogen in the cell increased the permeability of glass. Suppose, Britz suggested, Paneth and Peters had not found the permeability problem. The helium must have looked "compelling" and they would have been convinced fusion was occurring. I countered that this would not be compelling for three reasons:

1. The results were not widely replicated. *Nothing* is compelling until it has been replicated. Suppose 200 other researchers performed this experiment, and they all observed helium. This large group of researchers would have checked every imaginable source of contamination more carefully than Paneth and Peters alone could have done. Eventually, someone would have discovered the increased permeability of the glass. You cannot fool 200 experimentalists. If you could, the experimental method would not work. I asserted there are no examples in the history of science of high sigma, widely replicated experimental result that later turned out to be an artifact. Britz countered by saying that polywater was widely replicated. He is wrong. Polywater was replicated by a few dozen researchers who reported the effect was at very low sigma, at the limits of detection.[8]

2. Helium results are inherently less compelling than excess heat or tritium, even today, because helium is so tricky to measure. Paneth and Peters' signal to noise ratio was low. Although we now believe helium permeated through glass in their experiment, we cannot be sure that is where it came from. Helium is difficult to detect because it is a stable element, it is ubiquitous and it permeates many materials. Radioactive tritium is much easier to detect.

3. Paneth and Peters detected helium alone, which gave us less to go on (less to be convinced by) than modern cold fusion. Cold fusion affords heat and helium, as well as tritium; anomalous copper, iron and other elements; x-rays; occasional charged particles; neutrons; and autoradiographs showing that cathodes often become radioactive. The multiplicity of this evidence is far more compelling than helium alone would be. Evidence becomes more compelling in context with other evidence from the same experiment, and from other, related experiments. This is another reason widespread replications are essential.

Preliminary, unreplicated results in a new field of science may be caused by hidden artifacts or "unknown factors." But this form of calorimetry has been performed millions of times over the last 200 years, and extensive calibrations are performed in each cold fusion experiment. By now, every artifact capable of producing a significant error has been caught. An "unknown factor" is invisible, untestable, unanswerable . . . which puts it outside the bounds of experimental science. If you cannot propose an experiment to test your hypothesis, and prove or disprove it, you are doing metaphysics, not science. A skeptical objection should be held to the same standards as evidence put forth in favor of the hypothesis. A skeptic must propose a practical, reasonable test of his ideas. To address the thermal gradient issue, you might demand two thermistors, or six, but not six-thousand. You can ask for 20 sigma results, but there is no justification for demanding 200 sigma.

A proposed error must come within orders of magnitude of the value needed to account for results. Britz insists than an error is "most likely" but he points to errors that can produce at most a few percent difference. In the discussion of gradients he cited Quickenden and Green:

> As I wrote before, I believe the error - if it was, which I regard as most likely but wouldn't state categorically - is more likely to be in the single thermistor measurement, i.e. neglect of temperature gradients in the cell. From others' work we know that there are such gradients, e.g. a significant vertical one, as well as a radial gradient. This would

Britz continued on page 77

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Construction and Testing of an Aspden-Adams Motor

by Brian W. Rex

1024 Beecher Avenue
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A small example of an Aspden-Adams motor was built using descriptions from UK Patent GB 2 282 708 B, Electrical Motor-Generator. The Motor was self-commutating, thus eliminating the need for an electric switching circuit. Three, pairs of opposing stator coils were connected in series, parallel, or simply left open while testing was performed. The motor used seven, neodymium magnets to provide the magnetic flux in the rotor. Testing of the motor showed no evidence of over-unity operation within the measurement accuracy of the experiment.

1. Introduction

There have been a number of reports in the new energy literature about certain types of magnetic motors that exhibit anomalous or over-unity performance. One of these is the Adams' motor, so when the Aspden-Adams electrical motor-generator patent was published in *Infinite Energy* (Vol. 2, No. 11), I became interested in building one.

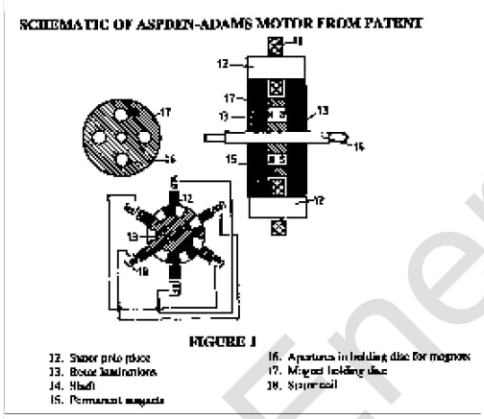
The thought that there may actually be a motor like John Galt's in Ayn Rand's novel, *Atlas Shrugged* was very intriguing to me, so I started designing one using the patent description.

2. Description

The motor that I decided to build is shown in Figure 1. I will not attempt to describe the operational theory or functioning of the motor, but refer the reader to the patent.

This embodiment of the motor was chosen be-cause the opposing stator coils could be connected to make the motor auto-commutating, thus eliminating the need for a switching circuit, which was beyond my technical skills and budget to design and build.

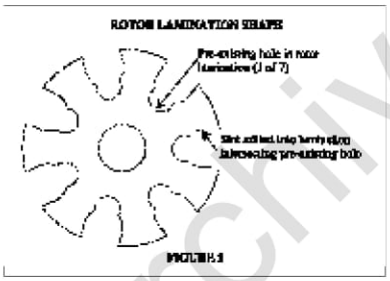
SCHEMATIC OF ASPDEN-ADAMS MOTOR FROM PATENT



The motor was identical to the schematic with the exception that seven magnets were used in the motor instead of four. Thus, the magnet holding disc (#17, Figure 1) had seven apertures instead of four. The seven magnets were in register with the seven poles of the rotor laminations. The magnets were nickel-plated, neodymium "super" magnets, 3/8" diameter by 1/2" long.

The rotor laminations were made from a junked squirrel-cage induction motor by turning the OD to approximately 2.5" and milling seven slots around the circumference. The junked motor laminations already had seven holes around the circumference near the shaft, which were partially milled out to create the seven poles of the rotor laminations. This resulted in less than ideal rotor shape, but such were the budgetary constraints of the research. The shape of the resulting rotor laminations can be seen in Figure 2.

The stator pole pieces were obtained from some small surplus computer transformers. The stator coils consisted of 150 turns of #30 gage enameled copper wire.



The shaft was machined from t/~" brass rod, and was supported by 2 ball bearings.

The magnet holding disc, as well as the bearing and stator supports were all fabricated from lexan plastic to eliminate any possibility of eddy currents being induced in these parts. The two bearing supports that formed the motor housing were connected with three,1/4" brass rods.

Some small shims made from the same material as the stator laminations were glued on the stators on either side of the coils. This was done to reduce the resulting air gap between the rotor poles and the stators. The excessive air gap (approx. .050") was caused by an amateur machinist (me). The shims reduced the air gap to approximately .020". These were in place for the first two data sets, but were removed for the last two data sets.

The completed motor can be seen in Figure 3.

3. Testing

The test set-up of the motor consisted of a conventional DC, permanent magnet motor (automotive blower motor) mechanically connected to the Aspden-Adams motor by a small length of reinforced rubber hose and two hose clamps.

A pulser disc was built and attached to the shaft of the Aspden-Adams motor for use with a model airplane tachometer to indicate the RPM of the entire two motor assembly.

A commercial 12 volt battery charger supplied power to the conventional motor, while two multimeters were used to measure the voltage and amperage supplied to the conventional DC motor.

Lastly, the stator coils of the Aspden-Adams motor were connected with switches. This allowed the stator coils to be quickly switched between parallel, series or open.

The object of the testing was to determine if any reduction in input power to the conventional DC motor could be measured when the stator coils of the Aspden-Adams motor were connected in series versus when they were left unconnected. This method eliminated the need for a very expensive dynamometer. Any anomalous or over-unity operation would be manifested in the efficiency (RPM/watt) of the two motor assembly as measured by the voltmeter, ammeter, and the tachometer.

Additionally, for some of the tests, a rheostat was used to reduce the voltage applied to the conventional DC motor to reduce the RPM of the set-up for data set #4. This was suggested by Dr. Aspden during a telephone conversation. The voltage and amperage measurements were, of course, made on the

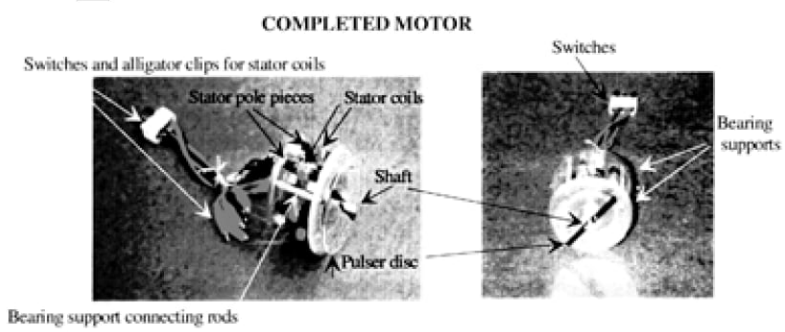


FIGURE 3

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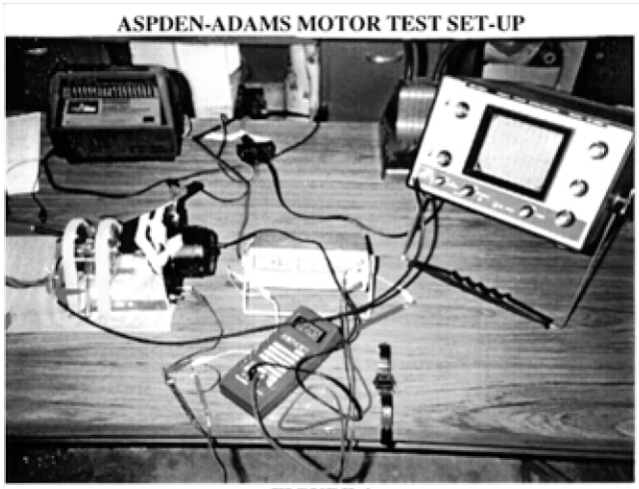

FIGURE 4

motor side of the rheostat.

The complete test set-up can be seen in Figure 4.

4. Results

The first series of tests was done with a Heathkit digital multimeter measuring voltage, and a Micronta analog meter measuring amperage. Also, a single trace Heathkit oscilloscope was connected to one of the stator coils to indicate voltage and waveform. This proved troublesome because of the difficulty in reading small changes in the amperage with the analog meter. Additionally, the purser disc for the Hangar 9 model airplane tachometer broke, and had to be repaired. Lastly, the motor mounts proved to be inadequate and had to be redesigned.

The waveforms from one of the stator coils are shown below for reference, since they were unaffected by the difficulties (Figure 5).

When the purser disc and the motor mounts were re-paired, another digital meter (Micronta) was obtained for more precise amperage measurements, and four sets of data were generated. These are reproduced below. The "Series" data sets represented the subject group, and the "Open" data sets represented the control group.

5. Discussion of Results

In each of the four sets of tests conducted on the motor, a statistical T-test was performed on the mean RPM/watt for open and for series connected stator coils. The T-test is a statistical method of determining whether or not 2 groups of samples are from the same population. In each data set, the T-test showed that the sample means were not from different populations with 95% confidence. Simply stated, this meant that no statistically significant difference was found by operating the motor with open stator coils or with the stator coils connected in series. In other words, no anomalous or over-unity performance was observed.

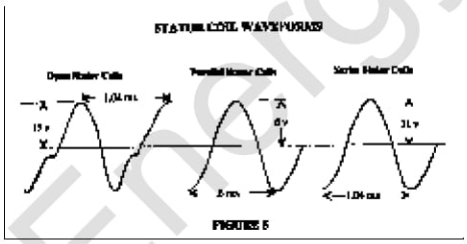

FIGURE 5

No attempt was made to analyze the waveforms observed on the oscilloscope. They were included herein for the interested reader (with more ability than myself) to analyze. (For example, the "bump" on the waveform of the open stator coils is interesting, but unexplained.)

Increasing the air gap between the rotor poles and the stators by removing the shims on the stators likewise had no noticeable effect on the performance on the motor other than decreasing the cogging of the motor. This was shown in data sets 3 and 4, with T-tests of 1.00 and .34, and T-values of 2.31 and 2.10, respectively. (The T-tests would have to be greater that the T-values to conclude that there was a statistically significant difference between operating the motor with open stator coils and operating it with the stator coils in series.)

Additionally, the stator coils were connected in parallel for data set #3. A noticeable slowing of the motor occurred, while the RPM/watt value also decreased. No statistical analysis was performed on this data, because it was obvious during other tests where the power was not measured that the motor was acting like a brake when the stator coils were connected in parallel.

6. Summary

In summary, the Aspden-Adams motor described in this report showed no anomalous or over-unity operation, as evidenced by the lack of difference in the sample means of RPM/watt measurements when the stator coils were left open

Data Set #1 September 25, 1997, 7:00 PM to 7:40 PM

	Series				Open			
Sample	Volts	Amps	RPM	RPM/Watt	Volts	Amps	RPM	RPM/Watt
1	12.25	4.34	3950	73.34	12.21	4.31	-	
2	12.25	4.33	3950	73.25	12.10	4.15	3995	77.38
3	12.41	4.11	4000	78.42	12.10	4.19	4000	77.61
4	12.36	4.18	4150	80.53	12.43	4.07	4100	81.04
5	12.34	4.14	4050	79.28	12.48	4.01	4150	82.93
6	12.47	4.05	4050	80.99	12.51	3.94	4300	82.14
7	12.45	4.01	4050	80.72	12.43	4.03	4050	80.45
8	12.35	4.11	4000	79.12	12.43	4.00	4050	81.33
9	12.34	4.07	4050	80.64	12.38	4.00	4050	81.92
10	12.30	4.06	4000	80.10	12.49	3.96	4100	83.04
			Mean	79.04			Mean	81.09
			Variance	3.62			Variance	5.81

T-Test Observed
2 tails, unequal variance 0.84

T-value
95% Confidence 17 DOF 2.11

Data Set #2 September 27, 1997, 11:10 AM to 11:35 AM

	Series				Open			
Sample	Volts	Amps	RPM	RPM/Watt	Volts	Amps	RPM	RPM/Watt
1	12.27	4.24	3900	74.96	12.26	4.23	3900	75.20
2	12.28	4.26	3900	74.55	12.31	4.26	3950	75.32
3	12.32	4.20	4000	77.30	12.36	4.21	4000	76.87
4	12.39	4.17	3950	76.45	12.49	4.08	4050	79.48
5	12.47	4.04	4050	80.39	12.45	4.07	4050	79.93
6	12.44	4.04	4050	80.58	12.47	4.00	4100	82.20
7	12.44	4.02	4050	80.99	12.44	4.01	4050	81.19
8	12.43	4.02	4050	81.05	12.49	3.98	4100	82.48
			Mean	78.29			Mean	79.64
			Variance	7.71			Variance	7.23

T-Test Observed
2 tails, unequal variance 0.59

T-value
95% Confidence 14 DOF 2.15

Data Set #3 September 27, 1997 11:40 AM to 11:55 AM Shims Removed

	Series				Open			
Sample	Volts	Amps	RPM	RPM/Watt	Volts	Amps	RPM	RPM/Watt
1	12.88	3.45	4350	97.89	12.87	3.49	4300	95.73
2	12.91	3.46	4350	98.14	12.85	3.41	4350	99.27
3	12.85	3.40	4300	98.42	12.80	3.38	4250	98.23
4	12.86	3.37	4350	100.37	12.91	3.34	4350	100.98
5	12.86	3.32	4350	101.88	12.89	3.29	4350	102.57
			Mean	99.34			Mean	100.24
			Variance	2.98			Variance	3.61

T-Test Observed
2 tails, unequal variance 1.00

T-value
95% Confidence 8 DOF 2.31

	Parallel			
Sample	Volts	Amps	RPM	RPM/Watt
1	12.55	3.73	4150	88.65

Data Set #4 September 30, 1997, 7:00 PM to 7:30 PM Shims Removed

	Series				Open			
Sample	Volts	Amps	RPM	RPM/Watt	Volts	Amps	RPM	RPM/Watt
1	5.78	2.75	1950	122.68	5.80	2.73	2000	126.31
2	5.84	2.72	2000	125.91	5.84	2.71	2000	126.37
3	5.84	2.71	2000	126.37	5.89	2.69	2050	129.39
4	5.94	2.66	2050	129.74	5.92	2.65	2050	130.67
5	5.92	2.66	2050	130.18	6.00	2.65	2050	128.93
6	5.95	2.66	2100	132.68	6.00	2.64	2050	129.42
7	5.94	2.67	2050	129.26	5.97	2.65	2100	132.74
8	6.06	2.66	2100	130.28	6.01	2.63	2100	132.86
9	6.14	2.67	2250	137.25	6.17	2.66	2200	134.05
10	6.12	2.67	2050	125.46	6.06	2.63	2150	134.90
			Mean	128.98			Mean	131.04
			Variance	17.13			Variance	7.73

T-Test Observed
2 tails, unequal variance 0.34

T-value
95% Confidence 18 DOF 2.10

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or when connected in series.

No analysis or interpretation of stator coil waveforms was attempted.

7. Comments

I hope that this report does not become a "null" like those of cold fusion fame (infamy), if indeed, the Aspden-Adams motor turns out to be for real. I truly hoped that the motor would work. Why else would I have invested so much time and money in the project? However, I followed the description in the patent, built a motor, and tested it, but I saw no evidence of anomalous or over-unity operation.

Additionally, I want to add that the null result from this particular motor must not be construed to mean anything else than just that. It DOES NOT, for example, mean that none of the motors of Drs. Aspden or Adams work. Let's let the scientific evidence accumulate and make rational decisions based on evidence!

Acknowledgements

The author wishes to thank Derek DeVries for providing test equipment and Lynn Abrahamson for providing test equipment and assistance in testing the Aspden-Adams motor.

About the Author

Brian W. Rex was born in Logan, Utah and attended Brigham Young University where he graduated in 1990 with a degree in mechanical engineering. A two year stint in South America as an LDS missionary made it clear to him that abundant, cheap energy was needed by everyone. The CF announcement in 1989, while he was at BYU seemed very promising, but graduation and family pushed active interest in CF and new energy to the back burner. His interest was rekindled in 1995 when he met Marvin Hawkins and talked with him about CF and the 1989 announcement. Brian is currently employed as a structural analyst for a major aerospace firm to the present.

Britz continued from page 74

put their results out by considerably more than their stated precision in the measure heats, of 0.2% or so. My mate Todd Green did what was probably the most careful calorimetry in this system and had an error band of about +-1.5% (and the XS heat stayed within that band, see Quickenden & Green, *J. Electroanal. Chem.* 344 (1993) 167).

Pons and Fleischmann and others reported 300% excess. (High heat was measured by the boil off method and more recently with conventional thermometry. Britz ignores the latter results because they are not peer reviewed.) Errors of 1.5% are orders of magnitude too small. Britz would reject a cold fusion nuclear theory that explains only 0.5% of the heat, yet he clings to skeptical objections that fall short by the same margin.

Too Open Minded

Britz has rigorous standards when he examines cold fusion experiments. He will reject a paper on the slightest provocation. But when it comes to judging anti-cold fusion arguments, his standards are reversed. He becomes so open-minded his brains fall out of his head (as the skeptics say of us). He grasps at a 0.2% straw to explain a 300% result. He believes I am capable of forging a message from Melvin Miles. He strains to find merit in sloppy anti-cold fusion papers and polemics, overlooking egregious errors, crackpot claims, and Alice-in-Wonderland physics.

To raise doubts about cold fusion, Britz often cites the paper by Jones et al. He says he was "a bit impressed with it" because Jones "did show that recombination CAN give rise to excess heat artifacts." I reminded him that this has been common knowledge since Faraday characterized electrolysis in 1833. He did not respond. He said Jones "goes a bit over the top" because Jones implies that all cold fusion excess heat results can be explained as recombination. (On Internet Jones has even suggested this is true of McKubre's closed cells, cells in which excess heat exceeds the limits of recombination a hundred-fold, gas loaded cells with no oxygen, et cetera.) I asked Britz whether he agrees with Miles about other weaknesses in the paper: the test tube shape is absurd, and the power was set a thousand times lower than any other experiment, which insures recombination. Britz responded:

Yes, that did also seem slightly sneaky. I hear you say "SLIGHTLY??".

Britz judges papers severely but he is forgiving towards book authors. In his section of brief book reviews, Britz praises everything in sight, including Mallove's *Fire from Ice*:

It is clearly written by a "believer" in "cold fusion"; this is stated bluntly in the Preface and again and again in the text. Nevertheless, the book gives fair coverage to the skeptics' complaints and is well written. Mallove is both a professional writer and a scientist, and goes into some technical detail in places. He rightly argues against the facile dismissal of cold fusion by the "experts", who often use simplistic approaches and prove nothing.

He proves he is even-handed by praising other books which go into no technical detail, books which go into imaginary technical detail, and books from which relevant details has been stripped out and replaced by misleading, irrelevant detail and preposterous nonsense, like Hoffman's *A Dialogue on Chemically Induced Nuclear Effects*.[9,10] This book has many errors and strange omissions. In his 14 page bibliography Hoffman left out all papers about excess heat, which are the most important and convincing in the literature. He explained:

Listed bibliography concentrates solely on artifact considerations, not on the numerous studies of heat generation in deuterium/solid systems.

Since a large part of the book is about alleged artifacts detecting heat, it makes no sense to exclude papers about heat. Much of the book is devoted to the hypothesis that the heavy water used in cold fusion experiments is recycled moderator water from CANDU fission reactors. Hoffman thinks this explains the tritium results. The manager of heavy water production at Ontario Hydro told me that used moderator water is 100 million times too radioactive to sell to the public. He and Storms pointed out several large technical errors in Hoffman's discussion of heavy water and tritium. Britz did not notice these problems. He has nothing but praise for Hoffman:

. . . The book is reasonable in tone and definite conclusions are left to the reader to draw. One of the book's strengths is the emphasis on artifacts - both those that lead to apparent evidence for "cold fusion", and those that tend to suppress such evidence. . . . A wide range of technical problems is gone through in remarkable detail.

If a cold fusion scientist wrote two chapters about used heavy water from Candu reactors, Britz would call him a crackpot. He would never say "this is reasonable in tone."

The Taubes book[11] is the litmus test that separates "pathological skeptics" from a genuine scientific skeptics. In his on-line review, Britz says:

This book by physicist and aeronautical and astronautical engineer Gary Taubes, turned science journalist, focuses on the stories behind the story of cold fusion. It is based not only on newspaper reports and (a few) journal papers on cold fusion, but mostly on a huge number of interviews (over 260). The book is filled with material from these interviews. It deals mainly with the major US players in the area, i.e. the groups of/around Pons & Fleischmann, Jones and Bockris; some others, such as Huggins, Martin, McKubre etc are mentioned, as well as a very few foreign teams such as that of Scaramuzzi. This enables GT to go into great detail, and brings out the story very sharply. It ends (except for an Epilogue) in the middle of 1991, as the National Cold Fusion Institute closes its doors. The conclusion of the book is inescapable: "cold fusion" as used in this context is wholly imaginary. [***EDITOR's NOTE: Taubes is not a physicist and he did not, as far as we know, spend time as an engineer—he has a degree in engineering, but he never practiced engineering. He went straight into journalism.—EFM***]

Britz says there were "a few" journal papers. As far as I know, in 430 pages of text and 50 pages of footnotes, Taubes did not list a single title. He does list the people he interviewed. Most of them have not performed a cold fusion experiment or published a paper on the subject.

I will not address the politics in this book. Britz now agrees that Taubes is unfair, although he has not changed his on-line review. Let us consider only the technical issues. Britz is hung up about peer-review, and proper scientific form. He demands peer-reviewed proof of the number of thermistors in a cell. Yet he does not complain that this book is based on hearsay! When he looks at a cold fusion paper, Britz demands rigor and accuracy (as he should). How accurate and rigorous is Taubes? Taubes describes many experiments. I checked a few dozen of the descriptions against the actual papers. Every one of them was grossly wrong. Taubes asserts that researchers tried to measure tritium production without first determining baseline level of tritium in the heavy water. He says that open cell calorimetry is not "capable" of measuring 20% excess heat, a belief he ascribes to scientists at G.E. and "anyone else who has done careful calorimetry."[12] Here are a few detailed examples. Britz should have noted these, because he called these experiments "quality work" and he knows a lot about them.

Taubes claims that although the red dye in Pons and Fleischmann's cell mixed through the water in seconds, the cell might have had huge temperature gradients anyway, "say fifty degrees hotter on one side than the other." He concludes: "The temperature gradient in the flask simply had nothing to do with what might be called the red dye gradient. This also begged the question of why Pons and Fleischmann hadn't simply set up thermometers in the cell and collected temperature data . . ."[13] Needless to say:

1. Gradients are generally vertical, not horizontal. Hot water rises, it does not go south.

2. 50° C is a fantastic gradient. I cannot imagine a 50° C gradient in any direction in a test tube, even with a highly viscous fluid or a solid. I have never seen a gradient in water as large as 0.5° C, even after I did everything I could to encourage one. (Except the gradient immediately adjacent to the heater, as noted above.)

Britz continued on page 82

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Energy Development from Elemental Transmutations in Biological Systems

by Solomon Goldfein (May, 1978)

The work described in this report was authorized and funded by the U.S. Army Mobility Equipment Research and Development Command, Material Technology Laboratory, under Project MTL 01901, PMMR-26. Solomon Goldfein was the principal investigator for the effort. The work was under the direction of Emil J. York, Chief, Material Technology Laboratory. Robert C. McMillan, Chief, Radiation Research Group, provided guidance with regard to matters relating to physics and nuclear physics aspects.

Introduction

The object of this study was to determine whether recent disclosures of elemental transmutations occurring in biological entities have revealed new possible sources of energy.

Two investigators, Kervran and Komaki,[1, 2] have been recently nominated for a joint Nobel prize for their work involving the experimental proof that elemental transmutations were occurring in life organisms. Elements which were definitely proven to have been transformed were sodium (to magnesium), potassium (to calcium), and manganese (to iron). Actually, observations have been made for almost 200 years that elemental mutations were occurring, but little credence was given to them because they resembled alchemy—a relic of the middle ages.

From Jueneman,[3] investigations on transmutations can be traced from 1799 to the present.

The French Chemist, Vanquelin, in 1799, observed a large quantity of lime in the daily excretion of hens. To determine where the lime was coming from, he fed a captive hen a diet of nothing but oats. He measured the amount of lime in the oats, fed the oats to the hen, and then measured the amount of lime in the excretion and the eggs of the hen. The lime had increased fivefold. Vauquelin realized that lime had been created but he did not know why.

In 1822, Prout, an English experimenter, defined the transmutation of elements by studying incubating chicken eggs. He observed increasing amounts of calcium carbonate inside the egg and determined that the compound did not come from the shell.

In 1831, Choubard experimented with germinating watercress seeds. He observed new minerals in the young plants that were not present in the original seeds.

In 1844, Vogel also worked with watercress seeds. He placed his seeds in a controlled-air environment and added a sulfur-free nutritive solution to the seeds. The plants that grew from the seeds were found to have more sulfur than the original seeds. Vogel's answer was that sulfur was not a simple element or that sulfur was introduced from sources unknown.

After Vogel, Lauwes and Gilbert observed the weight variation during vegetation. In particular, they found a variation in magnesium.

In 1875, Von Herzeele also studied vegetating plants and discovered a weight increase in the ashes of the young plants.

Later, following the works of Vogel, Lauwes and Gilbert, Von Herzeele considered the variation in the weight of magnesium. He concluded that a transmutation of elements had taken place.

In 1960, Baranger, of France, published his findings on variations of calcium and phosphorus in germinating seeds. He also concluded that a transmutation had taken place, but he did not determine the reason.

In the early sixties, Louis Kervran's discoveries on transmutations were published by a French scientific review. Kervran demonstrated that not only molecules but also atoms could be transformed, and he verified the transmutation of matter from atom to atom.[4]

Komaki reported that eight strains of microorganisms grown in K-deficient culture media increase the total K by converting Ca to K — a fission reaction. A theoretical basis for Kervran's result has been discussed by de Beauregard.[5]

Working at the Ecole Polytechnique in Paris, Baranger, who also headed the organic laboratory, determined that transmutations were indeed taking place. Yet, none of these latter-day alchemists could propose a theory for the mechanism of such an unlikely appearing event as biological transmutation.

Summarizing, disclosures have been made of transmutations in micro-organisms, plants, and animals. Some have been fusion while others have been fission phenomena.

Investigation

In the search for clues to the possibilities for energy development calculations were macle to determine whether there was a net weight loss during the transmutations. This was followed by an examination of the most likely place for the event to occur and the presence there of the same elements disclosed to have undergone nuclear changes. A study then followed to determine if a mechanism was present which might cause such nuclear transmutations in accordance with presently accepted nuclear theory.

a. *Net Weight Change.* The study was limited to fusion reactions so that the difference in atomic number would be only one. These included Na, K, and Mn:

Sodium to magnesium where:

$$Na + H^{+} \longrightarrow Mg$$

Potassium to calcium where:

$$K + H \longrightarrow Ca$$

Magnesium to iron where:

$$Mn + H \longrightarrow Fe$$

The atomic weight differences were:

$^{23}_{11}Na$	+	$^{1}_{1}H^{+}$ ⟶	$^{24}_{12}Mg$
22.989 770 7		1,007 825 19	23.997 595 89
		true atomic weight	23.989 770 7
		loss of mass	0.007 825 19
$^{39}_{19}K$	+	$^{1}_{1}H^{+}$ ⟶	$^{40}_{20}Ca$
38.963 710 1		1.007 825 19	39.971 535 29
		true atomic weight	39.962 558 9
		loss of mass	0.008 976 39
$^{55}_{25}Mn$	+	$^{1}_{1}H^{+}$ ⟶	$^{56}_{26}Fe$
54.938 050 30		1,007 825 19	55.945 875 49
		true atomic weight	55.934 936 3
		loss of mass	0.010 939 19

Energy developed as a result of transmutation:

Conversion factor for atomic mass unit (amu) = 931 $\frac{MeV}{amu}$

Na ⟶ Mg	0.077 825 19 (931)	(7.29 MeV)
K ⟶ Ca	0.008 976 39 (931)	(+8.35 MeV)
Mn ⟶ Fe	0.010 930 10 (931)	(+10.18 MeV)

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b. *Energy Required for Nuclear Reactions.* No information has been discovered as to the energy required for these reactions to occur and, thus, whether there would be a net gain of energy. As far back as 1932, however, it was known that alpha particles having energies when ejected from radioactive elements of medium life of between 5 and 7 MeV could cause atomic disintegrations. Cockcroft and Walton built a tall, vertical tube capable of evacuation with a filament producing electrons at the top and a target of the element to be bombarded at the bottom. A low pressure of hydrogen was introduced and ionized by collisions with the electrons produced by the filament. The top of the tube could be raised to a high positive potential, up to 700,000 volts, the bottom being at earth. On reaching the bottom of the tube, the protons had a kinetic energy equal in electron-volts to the potential in volts at the top of the tube. Using a lithium target, at 45° to the bombarding protons, disintegrations of some of the lithium atoms into pairs of helium nuclei ejected almost in opposite directions were observed with only 120,000 volts.[6]

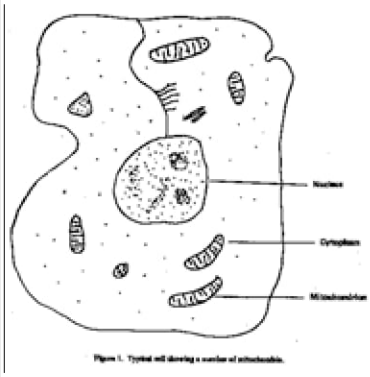
The reaction is:

$$H + Li \longrightarrow He + He.$$

Another such pertinent reaction was:

$$F + H \longrightarrow O + He.$$

c. *Probable Location of Energy Development.* The mitochondrion, a cylindrically shaped organelle, is universally recognized as the primary site for energy production in all life organisms regardless of whether they are one-celled bacteria, plants, or animals.[7] Some cells have as many as 7000 mitochondria (Figure 1). The mitochondrion is divided into compartments in which various reactions take place (Figure 2) [8]



d. *Chemicals Involved.* Adenosine triphosphate (ATP) is now recognized as the molecule most involved in energy production in the mitochondrion (Figure 3). When complexed with Mg++, it forms a cyclic ATP and proceeds through a series of reactions which produces energy (Figure 4).

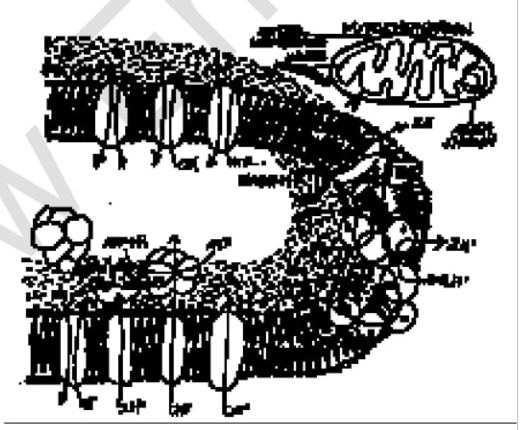


Figure 2. Membrane of the mitochondrion. (Drawing by Tom Higgins after diagram in *Scientific American*, March, 1978.)

e. *Energy Production.* The Mg++ is considered to be a catalyst for these reactions. One phosphate group after another splits off so that the resultant chelate becomes a diphosphate (ADP) and then a monophosphate (AMP). The phosphate groups hydrolyze, and the energy of hydrolysis for each reaction is 7,500 calories. The D-ribose then splits off and proceeds through a long glycolic decomposition cycle to yield further energy. The chelated, cyclic MgATP thus breaks up completely and is rebuilt through a series of chemical reactions. None of the decomposition and rebuild-ing cycles is as yet completely understood.

f. *Ions Present in the Mitochondrion.* Na, Mg, K, Ca, Mn, and Fe ions have been found to be present in the mitochondrion. These are the same ions which have been previously found to undergo nuclear transmutations by Kervran. In addition, another pair, Cu and Zn, differing by one proton (elements numbered 29 and 30) is also present.[9] H^+ and OH^- ions have been produced and are maintained in separate compartments.[10] Conversion of Cu to Zn is also accompanied by a loss of mass and thus a production of energy:

$^{63}_{29}Cu$	+	$^{1}_{1}H^+ \longrightarrow$	$^{64}_{30}Zn$
62.929 592		1.007 825	63.937 417
		true atomic weight	63.929 145
		loss of mass	0.008 272
$^{65}_{29}Cu$	+	$^{1}_{1}H^+ \longrightarrow$	$^{66}_{30}Zn$
64.927 786		1.007 825	65.935 611
		true atomic weight	65.926 052
		loss of mass	0.009 559

g. *Current Flow.* The net result of the many reactions occurring in the mitochondrion is a flow of electrons. [11] This flow is oscillatory in the MgATP crystal.

Gurney determined that removing a negative ion from the interior of a perfect crystal left a vacant lattice point to which a positive charge is associated. If this point is approached by a free electron in the conduction band, the electron will be attract-

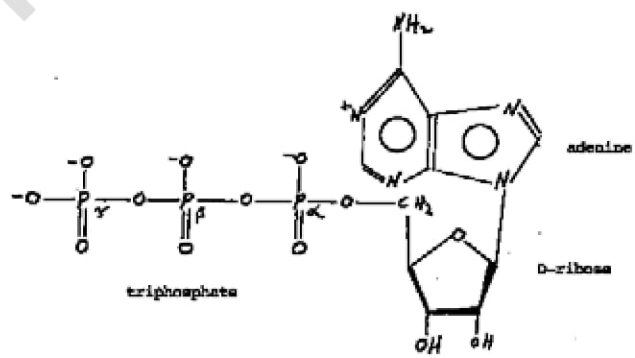


Figure 3. Chemical structure of adenosine triphosphate (ATP).

ed as from a positive-charged particle. Thus, if the electron loses energy, it may be trapped in the field of the charge. This trapped electron will undergo a series of stationary states toward a series limit. Beyond this limit, a continuum of states will exist. The periodic field of the lattice will cause periodic fluctuations on the wave function of the trapped electron, but the trapped electron will not be prevented from having a definite wave function, in each bound state, which will be like that of an electron within an atom in a vacuum and will be spread over many atomic distances in the crystal. [12]

Similarly, Gurney determined that removing a positive ion from within a perfect crystal left a vacant lattice point to which a negative charge is associated. If this point is approached by a free, positive hole in the filled electronic band, the free, positive hole will be attracted. If the free, positive hole loses energy, it will be trapped in the field of the negative charge. A set of stationary states toward a series limit will be encountered by the

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trapped, positive hole.[13]

Thus, in either case the current is oscillatory.

h. *Structure of MgATP*. The complete conformational structure of MgATP has not yet been elucidated. A key problem has been the function of the Mg^{++}. Kothekar *et al.* [14] made a study of the changes in electronic charge and energy distribution in ATP and ADP after incorporation of Mg^{++}. They hypothesized that even though Mg^{++} is not absolutely essential for enzymatic action, its presence facilitates the action by modifying the charge distribution. The most likely position of Mg^{++} is symmetrical between the three P atoms. Binding between Mg^{++} and ATP was considered mostly ionic in nature. No detailed, acceptable information is yet available regarding the crystalline structure of MgATP.[15]

4. *Proposed Alternate Mechanism for Energy Production.* There is hardly a *material in life* organisms which performs only a single

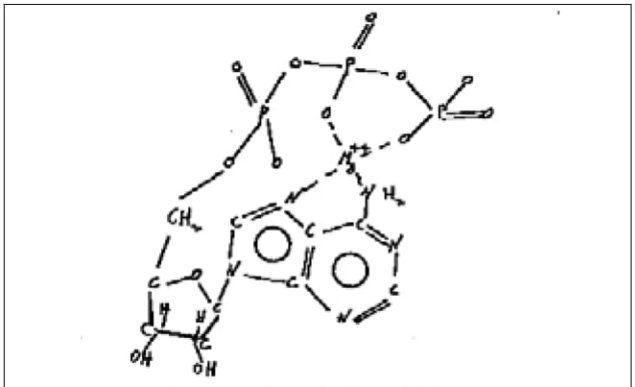

Figure 4. Chemical structure of adenosine triphosphate chelated with magnesium ion. (MgATP)

function. Therefore, MgATP was examined for an additional and alternate means of energy production which would encompass nuclear fusion reactions in accordance with recognized nuclear theory and practice. The principal method of producing nuclear reactions is by an accelerator— either linear or cyclic. E. O. Lawrence in the 1930s used the cyclotron resonance phenomenon as the basis for the cyclotron particle accelerator. He derived the equations of motion for a charged particle in a uniform, magnetic field with a constant period of revolution so that particles can be accelerated indefinitely in resonance with an oscillatory electric field. Recently, Hunter and McIlver developed a small spectroscope based on this principle.[16]

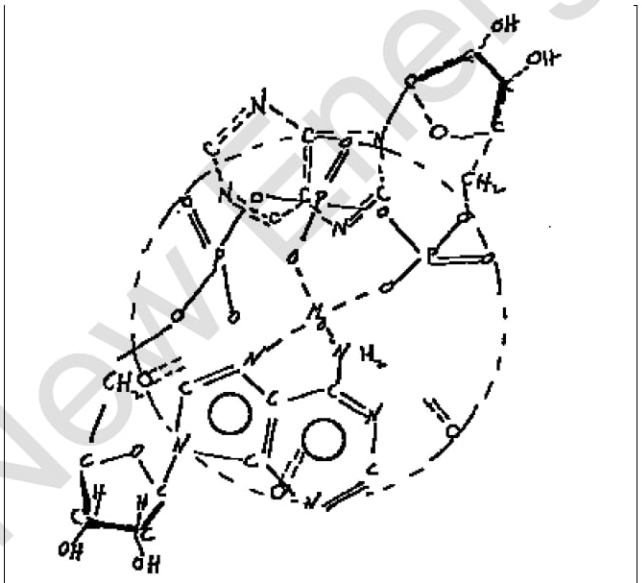

Figure 5. Planar view of two molecules of Mg chelated ATP one directly above the other facing each other. The dashed-line structure represents the lower molecule. The Mg^{++} is at the center of a circle with six dipoles spaced evenly around the circumference — three per molecule of ATP. The adenine part of the adenosine triphosphate straddles the perimeter.

In view of the lack of information regarding the crystalline structure of MgATP or its structure with regard to adjacent molecules of MgATP, it is hypothesized that the molecules of MgATP are situated one above the other, so located that the Mg^{++} forms a continuous chain. With the exception of the D-ribose unit, the complex or chelate lies in a plane. The D-ribose folds up — a phenomenon called sugar puckering.[17] Since the D-ribose molecules might interfere with each other under these conditions, the MgATP has been rotated so that the D-ribose units would lie 180° apart. A top view of the two molecules is shown in Figure 5. Since the P groups are equidistant from the Mg^{++}, it follows that they may be 60° apart around a circle whose center is the Mg^{++}. The acyl oxygen dipoles attached to the P atoms would likewise be situated around the circumference of the circle 60° equidistant. There is evidence that the dipoles might be situated 30° around the circumference in which case four molecules of MgATP would be required for

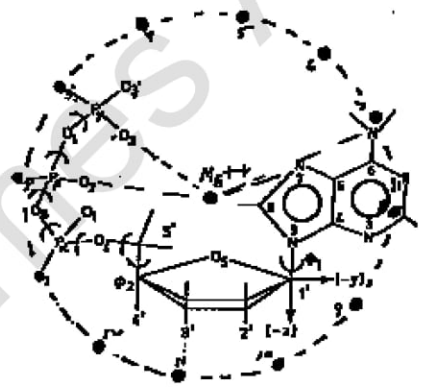

Figure 6. Planar view of four MgATP molecules showing twelve dipoles and only one Mg^{++} and adenosine molecule. Arrows show α, β, γ rotation of P atoms and, hence, dipoles 1, 2, and 3 when not chelated. Chelation prevents rotation of P atoms and could result in forcing dipoles out of the plane.

twelve dipoles to be present in the circle.[18] Figures 6 and 7 show top and side views respectively of such an arrangement. The phosphate chain is in the folded configuration and not extended as in anhydrous, inorganic triphosphates. It would form a helix, and torsion angles about the bonds have been calculated.[19] The net effect would be that the H^+ would make a helical path which would be circular as shown in Figure 7.

Dipoles have been found to be energized by unsaturation in the ionic structure—binding with metal ions with each dipole presumably requiring, on the average, one unsaturation or double bond.[20] Hughes and Rideal showed that a dipole is induced in a double bond if it is situated in the a position but not if it is further away.[21] In contrast, the presence of a double bond in the 4-5 carbon position of sphingomyelin increases the surface dipole and, hence, the surface potential of the monolayer.[22] No evidence exists, therefore, for a maximum-distance limitation. In this case, the unsaturation in the adenine molecule comprising four double bonds should, therefore, be sufficient to energize.e the three dipoles in the phosphate groups. The current formed by the electron flowing in an oscillatory fashion from one Mg^{++} to another must of necessity be accompanied by an oscillatory magnetic field. This could easily extend out to the perimeter and accelerate the 1-1+ to relativistic speeds. It would be guided in its path by the dipoles.

An interesting feature noticed in Figure 5 is the location of the ade-

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nine rings in the adenosine heterocycles. They sit directly on the circumference or perimeter of the circle formed by the acyl oxygen dipoles and 180° apart from each other. When a conjugated ring molecule is placed in a magnetic field, its electrons are caused to circulate and, in circulating, they generate secondary magnetic fields, *i.e.*, induced magnetic fields. The ring is fully conjugated and, hence, has a rotating ring current only when exposed to a magnetic field.[23] Because of the puckering effect of the D-ribose, the ring slopes and skews downward toward the perimeter. Its induced magnetic field,

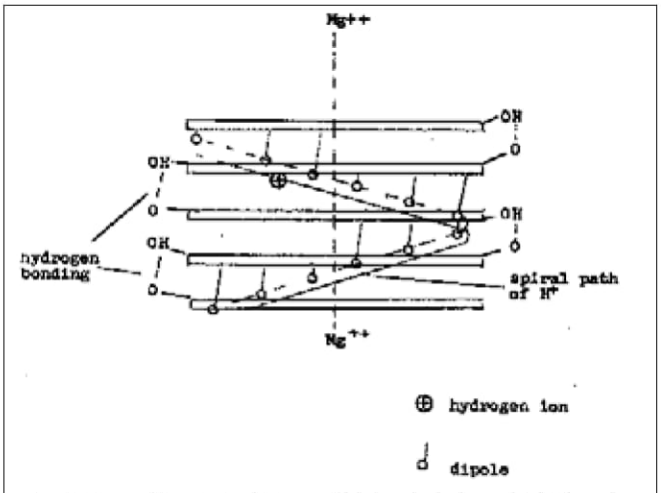

Figure 7. Side view of four molecules of MgATP. Possible hydrogen bonding between OH of D-ribose and genuine oxygen is shown.

thus, has a tangential component capable of exerting an accelerating force on the H^+ as it passes by.

Each requirement for a cyclotron particle accelerator has been met on a molecular scale as follows.

a. *Oscillatory Electric Field*. There is a continuous flow of electrons in the mitochondrion. The current oscillates as it flows through the chain of Mg^{++}s. The electric field accompanying the current oscillates in unison with it.

b. *Presence of Hydrogen ions*. Hydrogen ions are present in one of the compartments of the mitochondrion.

c. *Auxiliary Control and Propulsion of H^+ by Dipoles*. An H^+ introduced between the components of the sandwich would be attracted by an energized dipole and passed from one dipole to another around a helical circle having a diameter of approximately 30 Angstroms.

d. *Induction of Ring Current in Adenine*. The oscillating electric field induces an oscillating ring current in the adenine ring of the molecule.

e. *Effect of Magnetic Field on Hydrogen Ion*. As the H^+ passes under the ring, it is attracted by the magnetic field accompanying the ring current and accelerated to a very high speed. The H^+ soon approaches relativistic speeds because the ring current also is probably rotating at such speeds.

f. *Circular Helical Path of Hydrogen Ion*. In a crystal having four molecules of MgATP, the path of the H^+ is a circular helix. As many molecules of MgATP as are necessary would be present to accelerate the H^+ and impart sufficient energy to it to penetrate the nucleus of an atom and convert it to an atom of the next higher number.

Discussion

There were numerous evidences that the premise upon which the study was based was true, *i.e.*, that nuclear transmutations were indeed taking place in life organisms of all types. It was shown that there was a net loss in mass for the transmutations of Na, K, and Mn to Mg, Ca, and Fe respectively. These represented energies in the range of 8.35 MeV to 11.69 MeV. Although there was no information regarding the energy cost in effecting the transmutations, similar transmutations involving hydrogen ions were much less. Thus, there probably was a net gain in energy during the atomic transmutations.

The mitochondrion, well known as the location for energy production in the cell, was closely examined for clues as to the possibility of elemental transmutations also occurring there. The presence of the ion pairs (Na, Mg), (K, Ca), and (Mn, Fe) in the mitochondrion gave strong support to such a conjecture. Moreover, the additional pair (Cu, Zn) found there but not reported by Kervran or others provided added support. These were the only ions reported to have been found in the mitochondrion.

Adenosine triphosphate (ATP) in its chelated form with Mg as MgATP has been pinpointed as the source of energy in the mitochondrion. An examination of its structure indicated that when the molecules are placed one on top of another with the Mg^{++} in the center, the group resembled a working model of a cyclotron on a molecular scale. When MgATP is taken apart, its components can be burned to also form energy. An analogy would be a windmill or waterwheel made of wood. Both can harness the elements to produce mechanical or electrical energy. When they are taken apart and burned, the components produce thermal energy.

The question of the primary purpose of the transmutations is of considerable interest. From Komaki's work, it would appear that transmutations were used to maintain a balance of certain elements. In the human body, it is evident that health would be considerably impaired if it were attempted to obtain energy continuously from such transmutations. The body can tolerate just so much Na, K, Mg, Ca, etc., and the quantities are small.

No reports have been found of experiments which were made in which energy was measured along with elemental transmutation. Such experiments would be relatively simple to design and perform. The relatively available huge supplies of the elements which have been reported to have been transmuted and the probable large accompanying energy surplus indicate a new source of energy may be in the offing— one whose supply would be unlimited.

Conclusions

It is concluded that elemental transmutations occurring in life organisms are accompanied by losses in mass representing conversion to thermal energy and that such energy probably is a net gain when compared to the amount required to effect the transmutation.

Footnotes

[1]C. L. Kervran, *Prev. en Biologie de Transmutation a Faible Energy*, Malorinx, Paris (1975).

[2] H. Komaki, *Rev. de Pathologie Comparee*, 67, 213 (1967); 69, 29 (1969).

[3]F.B. Jueneman, "The Transmutation of Species," *Industrial Research*, 19, No. 13, 11 (Dec. 1977).

[4]F.B. Jueneman, "The Transmutation of Species," *Industrial Research*, 19, No. 13, 11 (Dec 1977).

[5]O. Costa de Beauregard, *Proc. 3rd Int. Cong. Psych.* (Tokyo), 168 (June 1967).

[6] J. Cockcroft and B. Lewis, *Proc. Roy. Soc. A*, 136, 619; 137, 229 (1932), 154, 246, 26 (1936).

[7]Henry R. Makler and Eugene H. Cordes, *Biological Chemistry VI*, 601, 609, 618 (1966).

[8]*Ibid.*

[9]*Ibid.*

[10]*Ibid*, p. 609, note 1.

[11]Peter C. Hinkle and Richard E. McCarty, "How Cells Make ATP," *Scientific American 104* (March 1978).

[12]R. W. Gurney, "Ionic Crystals," *Handbook of Physics*, ed. Condon and Odishaw, 2nd edition, 8-49, Section 12 (1967).

[13] *Ibid.*

[14]V. Kothekar, R. S. Tyagi, and R. K. Mishra, "Molecular Orbital Calculations of Magnesium Complexes with ATP and ADP," *Indian. J. Biochem and Biophysics*, 10 (4), 279-282 (1973).

[15]0. Kennard, *et al.*, "The Crystal and Molecular Structure of Adonosine Triphosphate," *Proc. R. Soc. London*, A325, 401-436 (1971).

[16]Richard L. Hunter and Robert T. McIlver, Jr. "Rapid Scan Ion Cyclotron Resonance Spectroscopy," American Laboratory, 9, No. 11, 13 (1978).

[17]0. Kennard, *et al.*, "The Crystal and Molecular Structure of Adenosine Triphosphate," *Proc. R. Soc. London*. A325, 401-436 (1971).

[18] *Ibid.*

[19] *Ibid.*

[20]O. Dinesh Shah and Jack H. Schulman, *Advanced Chemical Series 84*, 189 (l967).

[21] A. Hughes and E. K. Rideal, *Proc. Roy. Soc. Iondon*, A140, 253 (1933).

[22]0. Dinesh Shah and Jack H. Schulman, *Lipids* 2, 21 (1967).

[23]R. T. Morrison and R. N. Boyd, *Organic Chemistry*, 3rd Edition, 419 (1973).

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•Shah, O. Dinesh and Schulman, Jack, H., *Lipids*, 2, 21 (1967).

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3. It is impossible to imagine how the water could be held at such hugely different temperatures at different points when it is rapidly mixed in a small container. It is impossible to imagine how the water would have such huge temperature differences at different points when it is rapidly mixed in a small container. When you stir cream into your coffee, the coffee does not come out 70°C piping hot on one side of the cup, and room temperature on the other. This is a gross violation of the laws of physics. If Taubes could demonstrate this extraordinary phenomenon, he would win the Nobel Prize for capturing Maxwell's demon and making the poor demon work without his trap door!

4. Pons and Fleischmann do measure temperature, and they have checked for gradients extensively. These facts were in the peer-reviewed literature when Taubes wrote the book.

Let us look at Taubes' treatment of Robert Huggins. Huggins is one of Britz's favorite authors (and mine too). Taubes frequently repeats these particular claims, as he did during an NPR interview. Taubes says that Huggins made three mistakes:

1. Huggins and other cold fusion researchers did not measure voltage.[14]

2. Huggins did not realize that heavy water conducts better than light water. "The change in energy across the D_2O cell is higher, so that means that more power is dissipated, therefore the temperature is higher."[15]

3. Huggins overlooked the fact that over the weekend, power stations produce more electricity, and this extra electricity drives the temperature up. Taubes quotes William Happer, a hot fusion physicist at Princeton University, a member of the ERAB panel, and a top advisor the DoE Secretary Watkins: "On weekends, industries close down and it is common for live voltage to rise a little bit. Huggins didn't know about that. It'll go from 115 to 120 volts, which is a big effect, comparable to the effects he was looking at."[16]

In short, Taubes and Happer claim that Robert Huggins did not measure the electricity going into his cell. Because if Huggins *did* measure power (amperage times voltage), these statements make no sense. Suppose cell power consumption increased on Saturday night from 4 watts to 5. This extra input power would not masquerade as excess heat. By definition, excess equals output minus input. When output and input both increase by 1 watt, the computer log would show no net change in excess. If a D_2O cell consumed more power than a light water control cell, this fact would also be recorded, obviously. The weekend electricity hypothesis is also ridiculous because laboratory power supplies are well regulated. They deliver precisely as much power as they are set for, filtering out spikes and over-voltage. (So does the transistorized power supply in a portable computer, which is why you can plug in anywhere in the world without burning up the machine.)

Obviously, Huggins did record power, as any paper about his work shows. An electrochemical cell is never in a steady state. Power consumption fluctuates as bubbles form on the cathode. Impedance changes gradually as electrolyte is lost, or when the chemical composition of the electrolyte and cathode change. It would be impossible to conduct an electrochemical experiment without measuring electricity. The results would be meaningless.

These are not isolated technical errors. Anyone with basic scientific knowledge can go through the Taubes book and mark hundreds of similar examples of appalling ignorance. It is difficult to understand why Taubes, with engineering training, and Happer, an important U.S. government energy expert, would make such incredible statements. It is impossible to understand how a professional electrochemist could have overlooked these statements. Britz usually demands high standards of scientific accuracy. If this book presented a positive view of cold fusion, he would tear it to pieces.

Here is an e-mail message recently posted by Melvin Miles about the controversial paper by Jones and Hansen.[3] I forwarded this to Britz. He suspects I forged it.

I could readily use the published critique of my work by Jones and Hansen (*J. Phys. Chem.*, Vol. 99, pp. 6966-72, 1995) for examples that document my claims of their scientific distortions and outright dishonesty, but I still hope to have my reply published by that Journal. Hence I will use the recent publication by Jones, Hansen et. al, "An Assessment of Claims of 'Excess Heat' in Cold Fusion Calorimetry", in *Thermochimica Acta*, Vol. 297, pp. 7-15, 1997.

• False Statement #1 (Abstract)

"Claims of excess heat ---- are largely based on use of ---- calorimeters with single-point temperature sensors."

Jones and Hansen heard my seminar, asked many questions, and published a detailed critic of my work, hence they obviously know that I used two thermistors in my calorimeter. Is it then not dishonest of Jones and Hansen to make this statement concerning single-point temperature sensors? I have also worked with Fleischmann / Pons cells here at NHE. Their calorimeters also use two thermistors in each cell. These two thermistors are located at completely different positions, yet they give almost identical results.

• False Statement #2 (Abstract)

"Improper or incomplete calibration is a probable cause for many claims of 'excess heat'----."

There are no better calibrations than the many electrolysis experiments that produce no excess heat. The chemical and electrical heating calibration by Jones and Hansen do not reproduce the effect of the electrolysis gases leaving the cell or the change with time of the electrolyte volume during actual electrolysis. These effects must be considered in the calorimetric equations.

• False Statement #3 (Introduction)

"Claims of nuclear products ---- have largely been discredited."

The citing of their own two publications along with the notorious ERAB report in 1989 does not justify Jones/Hansen to make this statement. The ERAB report was published before I reported any evidence for helium-4. In fact, this report uses my early work to support arguments for no cold fusion effects.

• False Statement #4 (Introduction)

"Many claims of 'excess heat' ---- were the results of assuming 100% Faradaic efficiency---."

The studies by Jones et. al were done at very low current densities (0.5 to 4 mA/cm^2) where recombination effects are much more likely. Why not toss in platinum or palladium powder to show ever larger recombination effects? However, these are not the conditions for cold fusion experiments that require high current densities of $100mA/cm^2$ or larger. Fleischmann, Pons et. al made it very clear in their 1990 publication (*J. Electroanal. Chem.*, Vol. 287, pp. 293-348, 1990) that a threshold current density of 100 mA/cm^2 is required for the excess heat effect. Is it not dishonest of Jones to perform experiments in the wrong ballpark (low current densities) and then extrapolate these results to cold fusion experiments?

F. G. Will has clearly shown the errors of Jones et. al with respect to low Faradaic efficiencies (recombination) when they extrapolate their low current results to the high currents of cold fusion experiments. This is found in *J. Electroanal. Chem.*, Vol. 426, pp. 177-184, 1997.

Cold fusion scientists are not stupid. Recombination is the first thing we check before reporting excess heat. I keep a complete record of D_2O additions in every experiment, and always find that the D_2O consumption is in accord with Faraday's Law under normal conditions. (solid palladium rods are used that are kept completely submerged in the D_2O. All lead wires are covered with shrink Teflon). In fact, there is always a slightly larger loss of D_2O than calculated by Faraday's Law due to the evaporative loss of heavy water. Low Faradaic efficiencies (recombination) would result in less heavy water consumption than expected.

• False Statement #5 (Introduction)

"EPRI withheld further support after being informed of the results of the work done at low power."

Mike McKubre has recently commented on this false statement.

I find this to be a strange statement to place in a scientific paper. I really don't know any details but let me guess.

Jones et. al were working at very low current densities (low power) where recombination is much more likely despite the fact that cold fusion studies require high currents. EPRI then realized that Jones et. al were designing experiments to support their own agenda that excess heat is due to errors - rather than doing real research with an open mind. I would have also withheld further support under those conditions.

• False Statement #6 (Introduction)

"Fig. 1 A. Schematic of Typical 'Cold Fusion' Calorimeter."

Jones et. al depict a short, fat cell design with a single thermometer. This design is not used by anybody in cold fusion that I know. This short and fat "typical" cell is ridiculous and makes cold fusion experimenters appear incompetent. Mixing would certainly be a serious problem with such a design. My calorimeter design looks nothing like this, neither does the design of Fleischmann and Pons. Is it not dishonest of Jones to call this a "typical cold fusion calorimeter"?

I could go on but Fig. 1 A alone proves my point.

Who were the reviewers of this paper? Why didn't they do their job and check the facts? It is really a scientific shame that the anti-cold fusion papers by Jones et. al are so readily accepted by *J. Phys. Chem.* and *Thermochimica Acta*.

- Dr. Melvin H. Miles

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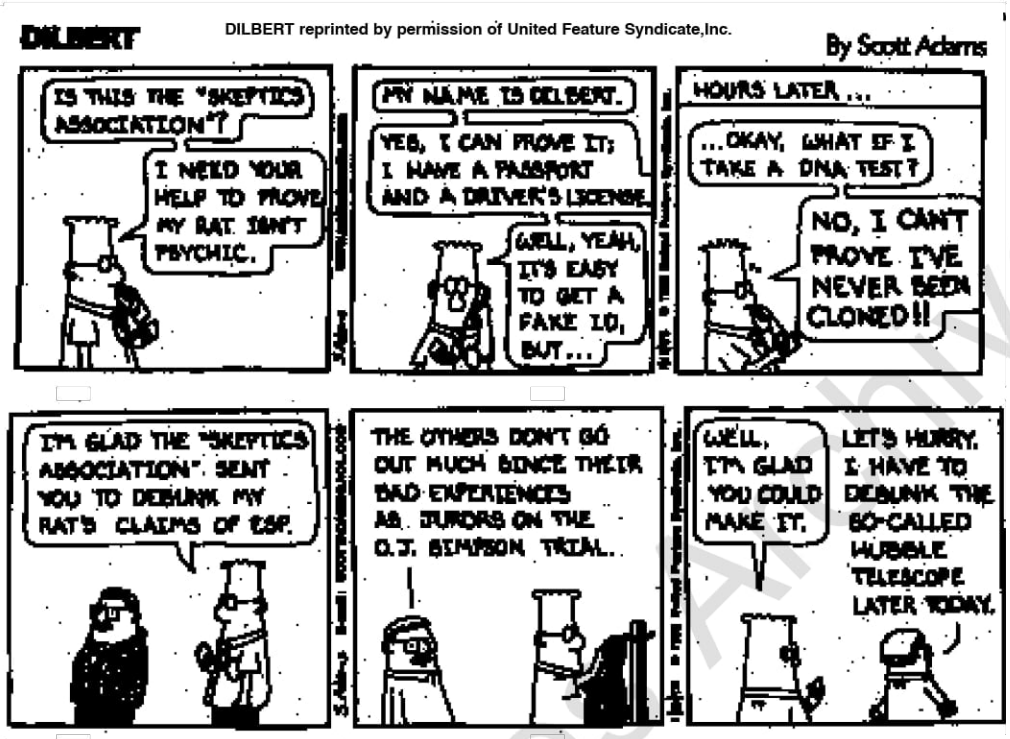
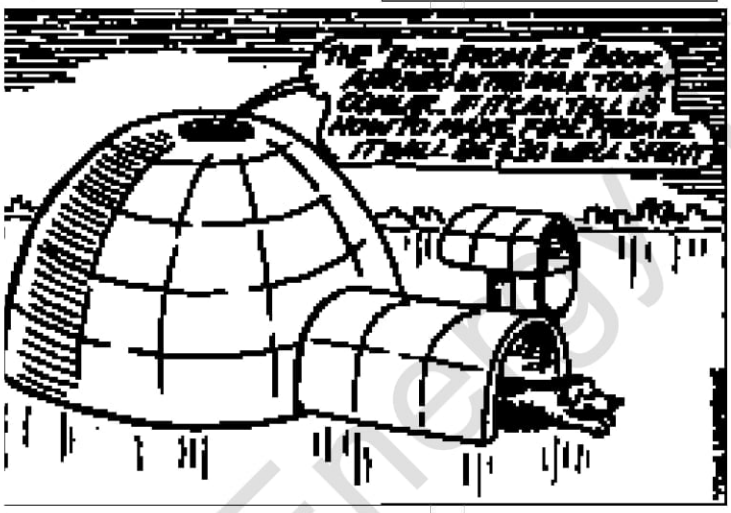
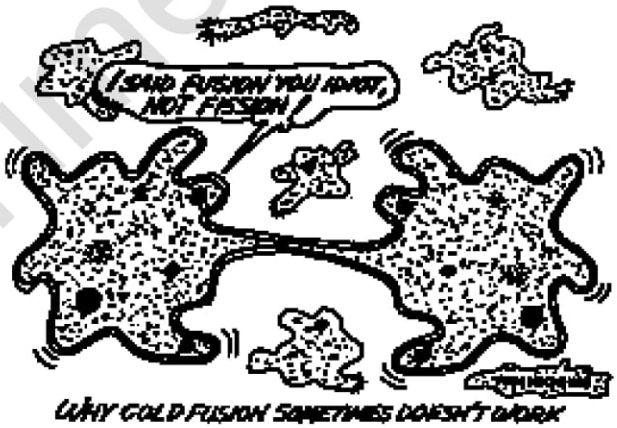
Cold Fusion Comix

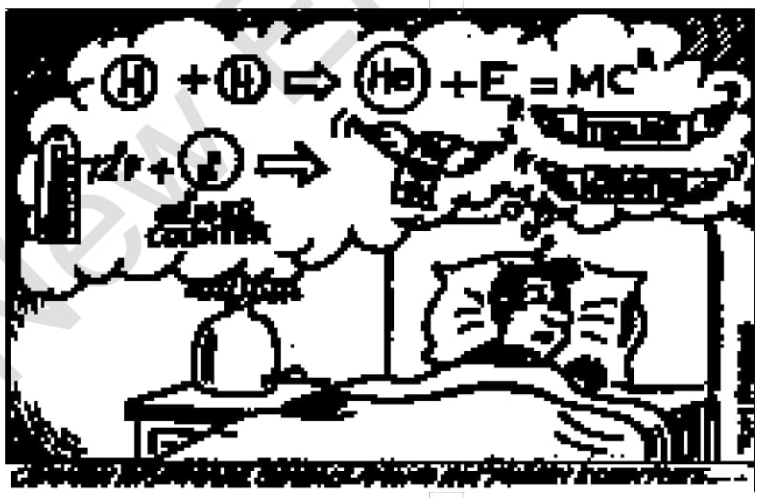
— A variety of humorous insights about the serious matter of New Energy, New Physics, and Scientific Heresy in general...



"In one word, it's garbage" *







*Martin Deutsch, Prof. of Physics Emeritus at MIT, *Science News*, Vol. 135, May 6, 1989. Remarking about Cold Fusion.

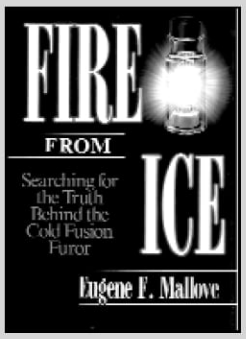
FIRE FROM ICE:

Searching for the Truth Behind the Cold Fusion Furor

By Eugene F. Mallove, Sc.D.

Published by John Wiley & Sons, Inc., 1991, 334 pp.

$25.95 No. America; $29.95 Other Foreign



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BOOK REVIEWS:

Forbidden Science: Suppressed Research That Could Change Our Lives

by Richard Milton

(Fourth Estate Ltd., London, 1994 - ISBN 1-85702-188-6) (14.99 pounds)

PEçIEΩEΔ BΨ ΣΥΣΑΝ ΣΕΔΔΟΝ

Milton's observation: "There are legitimate areas of science that are being neglected for non-scientific reasons," is one of the cornerstones of this fascinating book.

He cites many fine examples of scientific suppression in action, from the totally bizarre refusal of newspaper editors in Dayton, Ohio to believe the hundreds of callers jamming their switchboards with ridiculous tales of flying machines, to ripping yarns about inventors having to resort to pure showmanship, like Parsons with his "Turbinia", simply in order to get recognition for inventions which would ultimately change the world.

He describes with relish how the short-sighted "establishment" scoffed at Edison's electric lights, accused Baird of being a swindler and delights in quoting Lord Kelvin's repeated view that the discovery of x-rays was merely an "elaborate hoax".

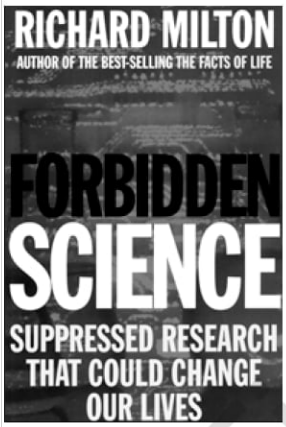
But Milton doesn't simply restrict himself to a reportage of the previously suppressed and now commonplace. He examines many issues which were once, and still remain, totally taboo.

In his chapter "The Gates of Unreason", he cites the psychokinetic claims of Geller; Picardi's research into electromagnetic effects on water-based chemical reactions. Subsequent chapters examine Gurwitsch's "mitogenic rays"; Mesmer and Reichenbach on "animal magnetism"; Kilner's work on the "human atmosphere" and how - quite literally on two occasions - Reich's bioenergy theories fanned the flames of scientific rebuke and derision.

In the highly controversial realm of taboos within medical research, he touches on Eysenck's maltreatment for suggesting that the adoption of *an holistic approach might* alleviate many of the harmful side-effects experienced with traditional drug-based therapy and discusses the "worthless charlatanism" which masquerades as beneficial hypnotherapy.

His ultimate conclusion here being that to discount any area of research in its entirety is to close off any interlinking avenues which could yield amazing breakthroughs. In short, that suppression isn't just immoral, it can seriously damage your health - potentially even kill.

He closes the first section of his book with a fine chapter on the twin travesties of the peer review system and general media suppression. His intriguing report on how a TV discussion on the causes of global warming was almost never shown, simply because it gave a balanced view in that it contained an open debate featuring disparate views, instead of just bland and irrefuted declarations of alleged facts. An incident which leaves one seriously concerned about just what other topics the "powers that be" consider too unpalatable for public consumption.



In the chapter, "The Research Game" he provides inspirational instances where scientists occasionally rebel against their "masters" and mankind ultimately benefits as a result. His most poignant example is the "bootleg" DNA research of Crick and Watson.

Incompetence at all levels within our organizational hierarchy is a subject he clearly warms to, with his tales of ineptitude within government departments, the military and - particularly - at prestigious scientific and medical research establishments.

He relates the following conversation which took place in 1988 between an eminent British psychology professor and one of his post-graduate students...

"*Student:* There seems to be a need for good quality research in the field of hypnosis. *Professor:* I would never allow it in my department. *Student:*- Why not? *Professor:* Because hypnosis is not a respectable field for research. *Student:* - Why not? *Professor:* Because it has no serious published literature. *Student:* Why is there no literature? *Professor:* Because nobody has done the research. *Student:* Why has nobody done the research? *Professor:* Because it's not a respectable field of research. "

Catch-22, it would appear, is no work of fiction after all.

Naturally, no book on *Forbidden Science* would be complete without relating the tale of cold fusion, and Milton's rendition is as entertaining as it is accurate.

From the enforced Pons/Fleischmann press conference; the peer review travesty; the frantic race for replication and the successes achieved by many prestigious laboratories, through to the turning point when hot fusioneers suddenly began to fret about their future funding and panic set in at Caltech and MIT. The latter organization's Director of Plasma Fusion research dispatching and then hastily retrieving his latex-coated allegations of fraud.

Eugene Mallove, our Ed-in-Chief and, at that time, Chief Science Writer in MIT's Press Office is accredited as the scissor-wielding seeker of truth who severed the elastic, sending the self-deluding Director's accusations springing right back to him.

Milton summarizes: "Cold fusion is the perfect exemplar of the taboo reaction in science. It runs entirely counter to intuitive expectation produced by the received wisdom of physics; it is a discovery by outsiders' with no experience or credentials in fusion research; its very existence is vehemently denied, even though Fleischmann and Pons have demonstrated a jar of water at boiling point to the world's press and television; and it is inexplicable by present theory: it means tearing up part of the road-map of science and starting again - unlearning the physics we have learnt."

In his postscript, Milton coins the expression "Paradigm Police" and, again, uses a literary analogy.

"They don't ride sinister black motorcycles nor throw people in jail (although even that is not unknown)... It is not our political thoughts they police, but the current paradigm."

Richard Milton was born in London in 1943. He has been a journalist writing on science and technology for more than 25 years. He combines a background as an engineer with experience as a newspaper editor and his articles have appeared in scores of magazines and newspapers. He is the author of the controversial bestseller* The Facts of Life: Shattering the Myth of Darwinism *(Editor's note: he is not a creationist) which reawakened widespread evolution controversy when it was published in 1992.

New Energy Times Archive

God's Secret Formula: Deciphering the Riddle of the Universe and the Prime Number Code

by Peter Plichta,

Element Books Limited 1997, US and Great Britain,
218 pages, Hardbound
ISBN 1-86204-014-1

REVIEWED BY EUGENE MALLOVE

This is an astonishing and provocative book by a respected chemist. The title is enough to prompt initial skepticism, or perhaps derision from those not inclined to explore claims of new cosmic insights, no matter from what direction they come. Let me assure you though, that whatever your "take" on the author's ideas turns out to be, this book is a most enjoyable and interesting read.

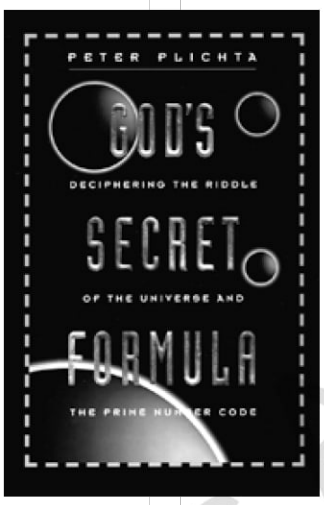
God's Secret Formula is, in essence, the dramatized scientific and personal autobiography of man in search of mysterious patterns in nature that he is convinced connects the prime numbers with *everything*. —including the very structure of space and time. It also chronicles a journey away from faith (he was born within the Catholic Church) and a return to a different faith after scientific discovery.

First, the author's credentials: Dr. Peter Plichta was born in Germany in 1939 and studied chemistry, physics, and biology. He is the author of many scientific publications and patents. He succeeded in synthesizing an oil from silicon (a silane compound)— what he calls "the fuel of the future" for air and space travel.

Because I know about cold fusion and new energy technologies, I have doubts about the future utility of Dr. Plichta's high-energy *chemical* fuel, whose discovery the author illuminates in fascinating detail—the explosions, the risks, the bold experiments. But the matter of the "prime number code" expounded by Plichta is much more difficult to dismiss outright. The theory may be all wrong (sheer numerology) or it may be completely or partially correct, but it is certainly an interesting point of departure for many scientific and philosophical discussions. There are apparent weak points, as when he discusses the origin of the value of the speed of light.

First, it must be said that this version of Dr. Plichta's insights is for a general audience. It contains some mathematical descriptions and diagrams that are complete enough to allow almost anyone to comprehend the gist of his arguments. Apparently he has published a more complete (and less accessible) highly mathematical *opus magnum*, in which much of the details and "proofs" of his thesis may be found.

Plichta is a man of strong opinions who does not mince words. Thus, he launches his tract with this observation: "More lies have been told in chemistry than in any other science. Nowhere is it possible to encounter so much bombastic bravado as in physics. And nowhere is there near as much foolishness as in biology, with its subdivision of medicine, since in no other area has so much total nonsense been propounded — and again forgotten — as in the science of living matter. In all three natural sciences, the current errors — and by this I mean not only minor but also major, and especially the most preposterous, errors — soon disappear from the textbooks and are replaced by new ones. We therefore always live with the errors that happen to be valid at the present moment." This is tonic that many newly paradigm-unparalyzed *Infinite Energy* readers might welcome.



Plichta throws the underpinnings of all scientific knowledge into doubt, and then proceeds to rebuild a foundation based on prime number patterns. He is at his weakest in this observation of pervasive triads of classifications within nature. He appears most strong in observing that the chemical elements have patterns heretofore unobserved.

He asks —and claims to answer— such questions as; "Why is the last stable element, 83, bismuth?"; "Why can there be no more than 10 isotopes of an element?"; "Why is the number of pure isotopes (e.g. gold or aluminum) in all the stable elements exactly 20?"

Plichta observes that when technetium (43) and promethium (61), which do not exist in nature, are removed from the table of elements, there are only 81 stable elements. Plichta then proceeds to perform mathematical wizardry—or *numerology*, if one dismisses his arguments—showing a pervasive pattern in nature revolving around 19 and 81 and the reciprocal of 81, i.e. 1/81. For preliminaries, he notes, for example that 19 + 1 = 20 pure isotopes—and coincidentally 1 + 19 = 20 amino acids (a reduced set involved in biology to which he attaches some significance.)

He reaches a pinnacle of his analysis in presenting a prime number schema on circular shells/with a spiralling-out quality that places significant primes on eight key radial lines. It is all quite beautiful and mysterious—especially in its apparent connection with claimed patterns of prime number distributions and the base-10 digits of transcendental numbers. No doubt there will be those who will claim to trash this easily as rank numerology.

The more technically inclined readership will be teased and provoked by statements such as: "I had now finally solved the question why two prime number elements in the periodic system should be missing. In 1986, I finally managed to prove why these two missing elements should happen to be the elements with the atomic numbers 43 and 61. The proof is rigorously mathematical, and critics will have to admit that the problem would never have been solved with conventional chemistry and physics."

By the end of the book, it is clear that Dr. Plichta has come full circle in his scientifically inspired religious thinking: "It was a decisive mistake that science began to interpret numbers as a human invention approximately 100 years ago, just so that mysticism could be expelled from science and mathematics. in this way, God was also expelled from nature."

There have been two schools of thought about "the unreasonable effectiveness of mathematics" in science: one believes that mathematics is a tangible, cosmos-centered reality independent of human thought—the "mind of God" as Einstein would have said. The other school thinks of our mathematics as a human-centered invention that can seriously delude us into thinking we have caught Truth by the tail. It is clear where Plichta stands, but less clear whether his sincere arguments should be or will be accepted. Read his book and decide for yourself.

God's Secret Formula:
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HERESY...OR INTUITIVE SCIENCE? by Susan Seddon

"Few people are capable of expressing with equanimity opinions which differfrom the prejudices of their social environment. Most people are even incapable of forming such opinions." — Albert Einstein

In a recent study into eccentricity, David Weeks and Jamie James(1) surveyed 789 self-declared eccentrics. These volunteers came from all walks of life and included housewives, physicians, educationalists, clergymen, entertainers and, of course, scientists.

An interesting profile of the archetypal eccentric inventor emerged.

Fundamentally highly creative, non-conformists they almost all shared the noble ideal of wanting to make the world a better place and its people healthier and happier without seeking personal financial reward of any kind.

Why such philanthropic motives should be regarded as somewhat abnormal is almost as mysterious as the apparent hostility shown by the "orthodox" scientific community towards these innovative, free-thinking individuals, and the concepts they strive to promote.

The accusation most frequently levelled at those who seek new solutions to old problems is that of doing "bad science" by manipulating fundamental scientific principles to make them fit with their results.

Such allegations are not merely a 20th century phenomenon, the history of science is littered with bitter accusations of fraud and heresy. The supposed "fine line" between genius and madness has always been, and continues to be, emboldened and widened by the science fraternity in the name of preserving the intellectual monopoly it cherishes so highly.

It does, however, beg the question - just what are they afraid of?

If those they so freely label "heretic" are to be regarded simply as eccentric lunatics, why do the science police fight so vehemently not just to trounce their postulations, but are seemingly unwilling to rest their case until they have called the individual's mental stability into question also?

One fact that is frequently glossed over in standard textbooks, is that today's heroes of science are yesterday's *personae non grata.*

Take that old heretic, Galileo, whose radical departure from accepted thinking got him hauled in front of the Inquisition in 1632.

Had they executed him, it would clearly only have been a matter of time before another worker founded heliocentric cosmology the telescope and got a handle on the laws governing falling bodies.

Galileo's experience was proof positive that fundamental truths and, possibly, especially those which cause ripples of disquiet to run through delicate social and scientific echelons, simply cannot, and will not, be suppressed indefinitely.

Kepler, perhaps because of his personal familiarity with the restrictions of the religious doctrines prevalent at the time, was understandably nervous about expounding new cosmological theories. Yet, despite his astrological and mystical eccentricities, he remains revered in today's science texts for his laws of planetary motion.

Charles Darwin kept his notes on evolutionary theory well-hidden. He too, was mindful of the fate of other unorthodox scientists. His speculations offended Christian doctrine and could have easily led to him following in Galileo's wake had he been formally accused of blasphemy or charged under the laws of sedition.

There are myriad accounts of such mis-treatment meted out to theorists whose ideas shake the foundations of scientific acceptability.

No one believed Harvey's model for the circulatory system. He too, was made an object of ridicule, despite his status as an eminent physician.

Mesmer was accused outright of fraud and yet, strangely, his work on the therapeutic effects of magnetism is currently undergoing something of a revival amongst modern medical researchers.

The scope for truly intuitive research narrowed considerably when science became the preserve of specialists who had little time for the tinkering of amateurs.

On that basis, the Wright Brothers and Thomas Edison would, therefore, presumably get short shrift from today's technical hierarchy.

Interpretation of data is still as subjective as it was in the 1700's when Priestley and Lavoisier observed the same phenomenon and yet regarded it in completely different ways.

The peer review process is considered to carry the final word on what is, or isn't, legitimate science. Had Lockyer been around to found *Nature* a hundred years earlier, it would have been interesting to see whether the prestigious journal would have sided with phlogiston theory.

Condemnation comes swiftly to those who seek to challenge the principles which "traditional" scientists hold so dear.

The standard defence for their summary dismissal of revolutionary ideas is that of protecting the public from quackery. In his book "Too Hot to Handle", Frank Close uses this excuse to justify his venomous attack on the work of Fleischmann and Pons by stating: "If these events became regarded as the norm for science then public confidence would be threatened."

A phrase which was probably also uttered at Galileo's inquisition.

Reference:

1. *Eccentrics* by David Weeks & Jamie James, 1995, ISBN 1 85799 396 9.

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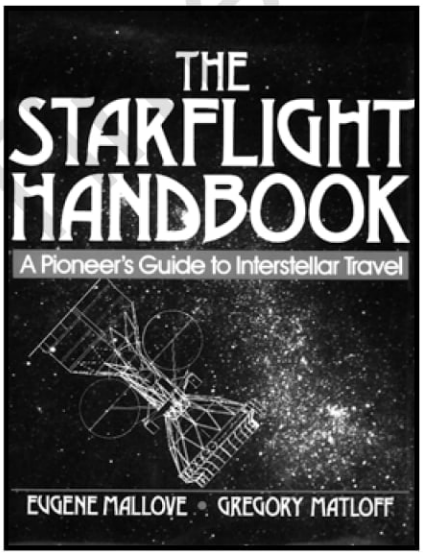

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